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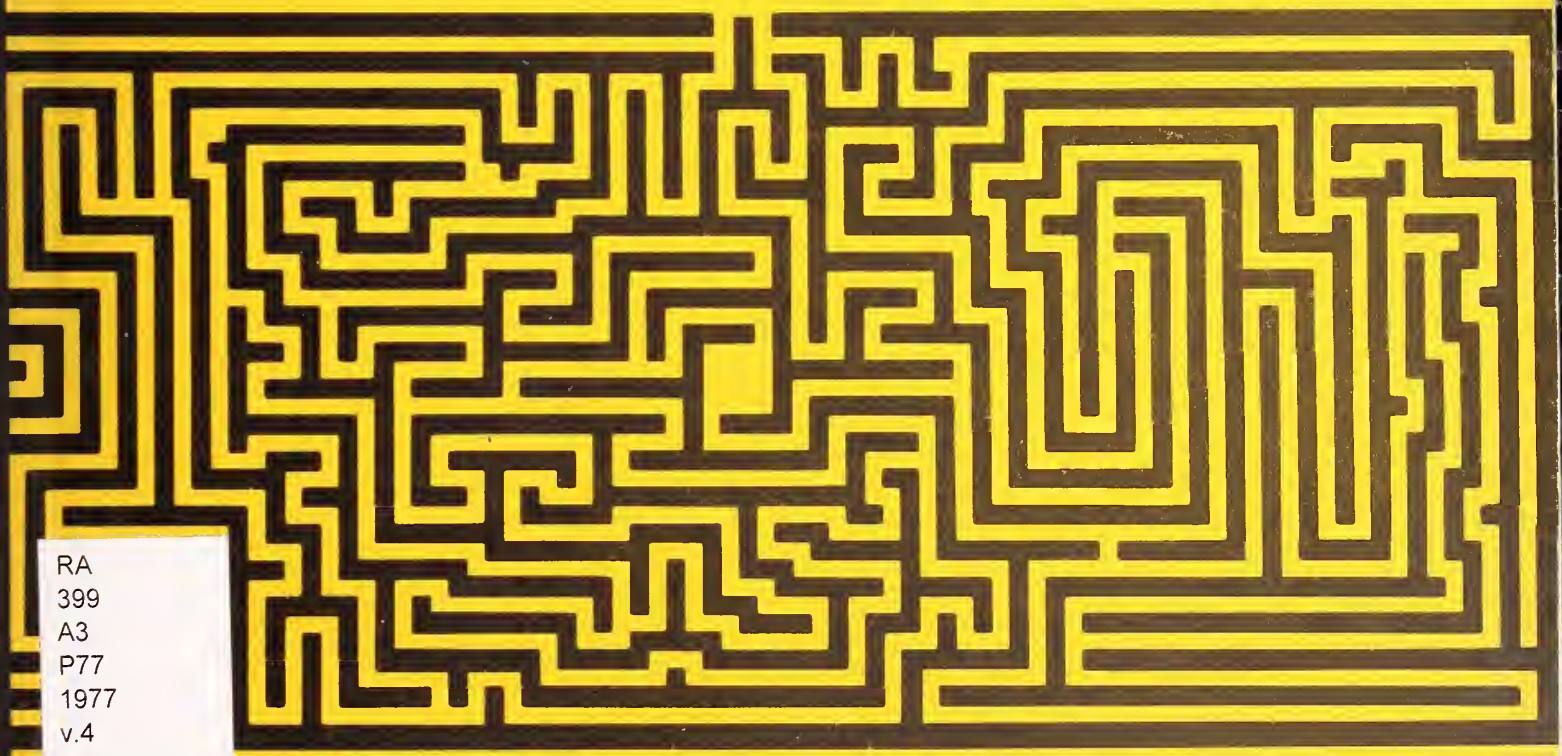
PSRO:
An Evaluation of the Professional Standards Review Organization

VOLUME 4:
ACUTE CARE UTILIZATION IMPACT:
INFERENCES FROM A SAMPLE OF HOSPITAL ABSTRACT DATA



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PSRO: AN EVALUATION OF THE PROFESSIONAL STANDARDS REVIEW ORGANIZATION PROGRAM

VOLUME IV

ACUTE CARE UTILIZATION IMPACT: INFERENCES FROM A SAMPLE OF HOSPITAL ABSTRACT DATA

October 1977

Report Number: OPEL 77-12

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PREFACE

This volume is a part of the evaluation of the Professional Standards Review Organization (PSRO) program conducted during fiscal years 1976 and 1977 by the Office of Planning, Evaluation & Legislation (OPEL) of the Health Services Administration, U.S. Public Health Service, Department of Health, Education, and Welfare. The emphasis of the evaluation was on program utilization control, quality assurance and cost-containment consequences and program costs. The evaluation was conducted at a time when the PSRO program was in an early stage of implementation. It indicates what impact the PSRO program had achieved by the start of 1977, provides baseline data for future evaluative work, and offers tests of numerous quality assurance and utilization control evaluation methodologies. Summarized below are the evaluation's salient findings.

The evaluation's primary study was an analysis of Medicare utilization data compiled expressly for this evaluation. The Medicare analysis investigated the effects of the PSRO program on hospital days of care per 1,000 enrollees, admissions per 1,000 enrollees and average length of stay. Eighteen active PSRO areas were compared to twenty-six matched non-active PSRO areas. No aggregate PSRO effect was found on the utilization variables studied. This implies that as a "treatment" the PSRO program thus far has not impacted on Medicare utilization relative to other forms of utilization review being conducted in non-PSRO areas. While no overall utilization savings were found, individual experiences varied. Some of the organizations were associated with lower (favorable) utilization while

others reflected higher (unfavorable) utilization than their matched comparison areas. These findings imply that, even though certain PSROs have demonstrated some degree of cost-effectiveness the PSRO program as a national program is not now functioning as an effective cost-containment mechanism. Conclusions concerning appropriateness of care are inconclusive since both increases and decreases in utilization are consistent with heightened appropriateness of care.

An analysis of hospital discharge abstract data, primarily derived from the Commission on Professional and Hospital Activities' (CPHA) Professional Activity Study (PAS) system, indicates that PSRO review tends to be associated with increases in case mix severity for Medicaid patients, but not for Medicare patients. The same data indicate smaller (unfavorable) decreases in case mix adjusted average length of stay (ALOS) for Medicaid patients in hospitals under PSRO review than in non-PSRO comparison hospitals and greater (favorable) decreases in ALOS for Medicare patients. It was also found that in some instances, the proportion of longer stays in PSRO hospitals experienced a relative decline. The ALOS findings, both favorable and unfavorable, were statistically significant yet rather small (on the order of 2%). The severity finding, while tentative for numerous methodological reasons, does suggest that PSROs may utilize bed days more efficiently.

Quality-oriented components of the PSRO program are just now being implemented. A study of a sample of medical care evaluation studies (MCEs) indicates that these studies were effective in identifying and correcting problems of medical care in hospitals. The number of initial audits reported has

grown to over a thousand per quarter, but the number of re-audits reported is small. Choice of MCE topics is likely to effectively reveal problem areas but is not necessarily based upon a critical selection process. Profile analyses, which can aid in the focusing of both concurrent review (CR) and MCE studies, are implemented in only a few PSROs.

It was found that the estimated cost of a fully implemented acute care hospital PSRO program for Federal beneficiaries is $268.50 million. Associated Federal discharge unit costs are currently $18.31 for primarily delegated PSRO areas, and $16.00 for primarily non-delegated PSRO areas. The PSRO program is more expensive than its predecessors. The cost of the original utilization review (UR) regulations was found to be $81.3 million while implementation of the revised UR regulations would have cost about $107.6 million.1/ In order to "recover" its costs the PSRO program would have to reduce utilization rates of covered populations by 1.6 to 2.05 percent.

The report cautions the reader against reaching final conclusions about the program since the evaluation was conducted during the time the program was in the developmental stage. However, data are sufficient to strongly suggest that continued PSRO implementation alone is not apt to cause significant changes in either hospital utilization rates or associated governmental expenditures.

1/ Original UR cost figure adjusted to 1976 cost levels.

Considerably more study is urged in several important areas as program development and implementation is continued. Many issues have been identified in the course of the evaluation which should be of value in deciding on the direction of future work.

PSRO EVALUATION REPORT VOLUME STRUCTURE

Volume 1: Executive Summary

Volume 2: A Context for PSRO Evaluation: The Program and Evaluation Precedents

Volume 3: Acute Care Utilization Impact: Some Data on the Medicare Experience

Volume 4: Acute Care Utilization Impact: Inferences from a Sample of Hospital Abstract Data

Volume 5: A Comprehensive Case Study: The Colorado PSRO Experience

Volume 6: Case Studies of PSROs: A Contextual Analysis

Volume 7: PSRO Quality Impacts: Inferences from the Medical Care Evaluations

Volume 8: The Costs of Utilization Review Programs in Hospitals and in PSROs

Volume 9: Acute Care Utilization Review Costs Associated with the Medicare/Medicaid Programs

Volume 10: Acute Care Utilization Review Costs: Synthesis of Components and Estimates for a Fully-Implemented Program

Volume 11: A Cost-Benefit Context for PSRO Utilization Control Activities

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1. INTRODUCTION AND SUMMARY

1.1 OBJECTIVES OF THE STUDY

The Health Services Administration, U.S. Department of Health, Education and Welfare, as mandated by Public Law 92-603, has established a Professional Standards Review Organization (PSRO) Program to control the cost and improve the quality of medical care provided to Title V (Maternal and Child Health), Title XVIII (Medicare), and Title XIX (Medicaid) recipients. Although this program is only in its early stages, the National Professional Standards Review Council must report to the Executive Branch and Congress on the progress and accomplishments of the PSRO Program to date. In order to meet this mandate, HSA has undertaken a short-term evaluation of the PSRO Program for the National Council. In the short run, it will be difficult if not impossible to address issues such as cost and health status impacts on a nation-wide basis. Instead, early assessments of the Program's effectiveness focused on demonstrable changes in utilization patterns.

A major component of the PSRO Program, and one that was among the first implemented, is concurrent review (CR), which involves certification of hospital admissions and assignment of continued stay periods appropriate to, and medically necessary for, treatment of particular patients. To the extent that utilization patterns are found to be influenced by CR, it is also important to determine whether these changes are related to characteristics of the review process (e.g., delegated vs. non-delegated review), characteristics of the hospitals (e.g., size or occupancy rate), or characteristics of the PSRO area (e.g., availability of extended care beds).

For the purposes of this study, concurrent review was defined as the hospital review activity conducted under the auspices of the PSRO program. The hospitals not conducting a PSRO-sponsored review activity were defined as comparison, or non-concurrent review, institutions. It should be noted that the comparison hospitals, defined as non-concurrent review, were required by regulation to conduct utilization review. In some cases, the utilization review process used by comparison hospitals may have included non-PSRO, in-house, current review during the time period included in the study. Therefore, the evaluation presented in this report assesses the marginal impact of PSRO concurrent review on hospital utilization against the effects of a range of activities constituting non-PSRO utilization review.

A Hospital Discharge Abstract Data Base consisting of approximately 1.3 million patient episodes was developed as an earlier project for OPEL. The Data Base is described in Chapter 4 of this document. The purpose of this project was to analyze these data in order to explore the short-term effects of PSRO Concurrent Review on Medicaid and Medicare hospital utilization.

In order to examine changes in utilization patterns for particular types of disease conditions, the diagnoses in the Hospital Abstract Data Base were collapsed into twenty-one specific diagnosis groups and one residual diagnosis group. In addition, a second set of diagnoses was used in the analysis of disease severity which was different from the diagnosis groups in the main utilization analysis but matched the diagnoses for which stage definitions were available. Both sets of diagnosis groups used in the evaluation are defined in Chapter 3 of this report.

1.2 SUMMARY OF FINDINGS

Based on the analysis of changes in Medicare and Medicaid utilization for the hospitals conducting PSRO concurrent review and the comparison hospitals included in the study, the principal findings may be summarized as follows:

- The principal measures of utilization included in the analysis, Average Length of Stay (ALOS) and % Long Stays, declined significantly for both the PSRO concurrent review and comparison hospitals over the study time period. For the Medicare population the PSRO concurrent review hospitals showed significantly greater reductions in ALOS and % Long Stays than the comparison hospitals. In contrast, for the Medicaid population, the comparison hospitals apparently reduced ALOS more than did the PSRO concurrent review hospitals over the study time period. Analysis of individual diagnosis groups showed no consistent overall pattern; most diagnosis groups evidenced no significant net increases or decreases in ALOS or % Long Stays for the PSRO concurrent review hospitals versus the comparison hospitals.

- Analysis of changes in diagnostic and severity case mix indicated a secular trend toward a more severely ill mix of patients at the hospital level. This pattern, in conjunction with the principal finding of overall reductions in average length of stay (ALOS), tends to indicate a trend toward more appropriate hospital utilization for both the PSRO concurrent review and comparison hospitals over the time period included in the study.

- For the Medicare population it was found that non-delegated PSRO concurrent review hospitals achieved significantly greater reductions in ALOS

than the comparison hospital group, while little difference was observed between delegated PSRO concurrent review hospitals and the comparison group. Consistent results were observed for the Medicaid population where no significant differences were found between non-delegated PSRO concurrent review and comparison hospitals, while the comparison hospitals reduced ALOS significantly more than delegated PSRO concurrent review hospitals. These findings imply that, to date, PSRO concurrent review has been more effective when implemented on a non-delegated basis than when hospital employees perform the concurrent review activities.

- An analysis of the impact of hospital and catchment area characteristics on changes in ALOS yielded the finding that, for the Medicare population, the ratio of extended care facility (ECF) beds to county population over age 65 had a strong impact on PSRO effectiveness. In areas with relatively high availablity of ECF beds, the PSRO concurrent review hospitals achieved significantly greater reductions in ALOS than the comparison hospitals while in areas with low ECF/population ratios the PSRO concurrent review group was no more effective than the comparison group in reducing ALOS. These findings reinforce the hypothesis that more appropriate hospital utilization will only result from a combination of effective utilization review and facilities planning activities.

The major findings presented above are supported by the summaries in Section 1.2.1 for Medicare and Section 1.2.2 for Medicaid and by the detailed analytical results presented in Chapter 5 for Medicare and in Chapter 6 for Medicaid. The findings for each payment category are further organized by type of impact measure (ALOS, LOS distribution, diagnostic mix, admissions and

days of care, exclusions, and disease severity). Each finding is followed with a reference to the section(s) of the report in which detailed analysis results are reported.

1.2.1 Medicare Findings

A pre/post analysis of ALOS and ALOS adjusted for patient mix for PSRO concurrent review and comparison hospitals was performed using a multiple regression model to test the significance of observed differences. It was found that:

- Both PSRO concurrent review and comparison hospitals experienced decreases in ALOS and ALOS adjusted for patient mix over the time period of the study. However, the decrease experienced by PSRO concurrent review hospitals was approximately .2 days greater than the decrease for comparison hospitals. This result was statistically significant, implying a positive impact of PSRO concurrent review in reducing ALOS for Medicare patients. (Section 5.2.2)
- Analysis of changes in ALOS for 21 selected diagnostic groups yielded no statistically significant differences between reductions experienced by PSRO concurrent review and comparison hospitals. Therefore, although the PSRO concurrent review hospitals showed greater decreases in ALOS than comparison hospitals for all patients combined this finding was not supported for the individual diagnosis groups included in this study. (Section 5.2.3)

A further analysis of ALOS was performed to investigate whether or not PSRO, hospital and catchment area characteristics had an impact on observed changes between the concurrent review and comparison hospitals. The variables included in this analysis were: teaching status of the hospital, occupancy rate, number of short-term beds in the hospital, M.D.'s/1000 county population,

extended care beds/1000 county population aged 65 and over, short-term beds/1000 county population, and hospital delegation status. It was found that:

- Controlling for the independent variables to eliminate sampling bias did not materially change the results of the primary Medicare ALOS analysis which showed that the PSRO concurrent review hospitals decreased ALOS by .23 days more than the comparison hospitals. With the independent variables accounted for, the PSRO review hospitals experienced a statistically significant .21 day greater reduction in ALOS than the comparison hospitals. (Section 5.2.2)

- For both PSRO concurrent review and comparison hospitals, significantly greater reductions in ALOS were experienced in teaching than in non-teaching hospitals. When looking only at non-teaching hospitals, the PSRO concurrent review group was significantly more effective in reducing ALOS than the comparison group.

- For hospitals located in counties with high short-term beds to population ratios, the PSRO concurrent review hospitals performed significantly better than the comparison group, while in areas with low bed/population ratios no significant differences were observed between PSRO concurrent review and comparison groups.

- For hospitals located in counties with high ratios of ECF beds to population aged 65 and over, PSRO concurrent review hospitals experienced significantly greater reductions in ALOS than comparison hospitals. No differences were observed between the ALOS reductions experienced by PSRO concurrent review and comparison hospitals in areas with low ECF bed/population ratios.

The findings relating to ECF bed/population ratios were the most significant of the analysis of independent variables. They seem to imply that PSRO concurrent review activities can be most effective in reducing ALOS for Medicare patients in areas which have an adequate supply of extended care beds. (Section 5.2.4)

In view of the importance of the issue of hospital delegation status within the PSRO program, two separate regression analyses were performed comparing non-delegated PSRO concurrent review hospitals to the overall comparison group and comparing delegated PSRO concurrent review hospitals to the comparison group. It was found that:

- Both delegated and non-delegated PSRO concurrent review hospitals achieved greater reductions in ALOS than did the comparison hospitals. However, while the difference between delegated PSRO concurrent review hospitals and the comparison group was not statistically significant, the superior performance of non-delegated PSRO concurrent review hospitals versus the comparison group was highly significant.

This finding implies that the observed effectiveness of the PSRO concurrent review program has been primarily due to non-delegated PSRO concurrent review activities. (Section 5.2.5)

An analysis of the distribution of length of stay was performed to augment the analysis of ALOS. This analysis of percent long stay patients and percent short stay patients was similar to that performed for ALOS in that a multiple regression model was used to test the significance of observed pre/post differences between PSRO concurrent review and comparison hospitals. The major findings of this analysis are summarized below:

- PSRO concurrent review hospitals experienced a significant decrease in % long stays from pre to post. Moreover, this decline was significantly greater for the PSRO concurrent review hospitals than for the comparison hospitals, implying a positive impact of PSRO in reducing the % of long stay patients. (Section 5.3.2)

- The % short stays increased from pre to post for both PSRO concurrent review and comparison hospitals. While the increase in % short stays was statistically significant for PSRO concurrent review hospitals, it was not significantly greater than the increase experienced in the comparison hospitals. (Section 5.3.2)

The LOS distribution analysis was also performed for each of the 21 diagnosis groups used in the ALOS analysis. It was found that:

- PSRO concurrent review hospitals experienced statistically significant reductions in % long stays for 7 specific diagnosis groups and the "other" category. However, none of these declines were significantly greater than those experienced in the comparison hospitals. For one diagnosis group (Disc Displacement), PSRO concurrent review hospitals experienced a slight increase in % long stays while the comparison hospitals experienced a large decrease. The difference between the two hospital groups was statistically significant for this diagnosis. (Section 5.3.3)

- Significant increases in % short stays were observed for the PSRO concurrent review hospitals for five of the diagnosis groups. However, for only one diagnosis group (Chronic Ischemic Heart Disease) was this increase significantly greater than that experienced in the comparison hospitals. For one diagnosis group (Neuroses) comparison hospitals showed a significantly greater increase in % short stays than the PSRO concurrent review hospitals. (Section 5.3.3)

The ability to analyze changes in diagnostic mix, admissions, and total days of care was severely hampered by the lack of eligibility data. However, a limited analysis of changes in proportions was undertaken and it was found that:

- Hypertension, Inguinal Hernia without Obstruction, Ulcer, Cholecystitis/Cholelithiasis, Hyperplasia of the Prostate and Cataract all experienced significant reductions in the proportions of patients in PSRO concurrent review hospitals while Pneumonia, Congestive Heart Failure, Complications and Adverse Reactions, Chronic Ischemic Heart Disease, Acute Myocardial Infarction, and the "other" category experienced significant increases. (Section 5.4)

- When ALOS was adjusted for case mix none of the observed changes in ALOS could be attributed to changes in the mix of diagnoses for either PSRO concurrent review or comparison hospital groups. Therefore, observed overall changes in ALOS were apparently due to actual changes in the ALOS for specific diagnosis groups rather than changes in the diagnostic mix itself. When the diagnosis group specific changes in ALOS were accounted for in the

aggregate, it was found that an overall secular decrease in diagnosis-specific adjusted ALOS occurred. Moreover, the decrease was greater in the PSRO concurrent review hospitals than in the comparison hospitals. (Section 5.4)

- The ratio of PSRO concurrent review hospital admissions to total admission in both hospital groups decreased slightly (1.1%) but significantly from pre to post. A similar ratio calculated for days of care also showed a significant reduction (1.5%) from pre to post. While these changes are consistent with the hypothesis that PSRO review had the effect of reducing the admission rate and hospital days of care rate, the lack of eligibility data makes this finding extremely tentative. (Section 5.5)

Transfers, patients with stays over 100 days, deaths, and patients with age, discharge status, or length of stay unrecorded were excluded from the CPHA LSS Program and therefore from our primary analysis. Data for these patients were analyzed, however, to determine if observed changes from pre to post varied between the PSRO concurrent review and comparison hospitals. It was found that:

- Slightly higher proportions of patients were excluded from the PSRO concurrent review hospitals in each category than from the comparison hospitals in both time periods. However, there was very little change (less than .5%) from pre to post within each hospital group for any of the exclusion categories. (Section 5.6)

- ALOS for patients excluded from the comparison hospitals decreased from pre to post for all exclusion categories. The PSRO concurrent review hospitals, however, experienced a greater decrease in ALOS for transfers than did the comparison hospitals. For stays over 100 days and for deaths, ALOS actually increased in the PSRO concurrent review hospitals from pre to post, however, there were so few stays over 100 days as to make the finding relatively unimportant. (Section 5.6)

An analysis of disease severity was performed for 23 selected diagnoses using the "staging" index. To match diagnoses for which stage definitions were available, this set of 23 diagnoses was necessarily different from the diagnosis grouping used in the ALOS analysis. The staging index classifies patients for each of the diagnoses into one of three levels, or stages, according to the severity of the medical/surgical problem. Stage I represents a condition with no complications or a problem of only minimal severity; Stage II, a condition with local complications or problems of moderate severity; and Stage III is defined as a condition with systemic complications or problems of maximal severity.

Nine of these 23 diagnoses were conditions in which hospitalization is not always necessary for Stage I patients while 14 of the diagnoses normally require hospitalization at Stage I. The staging index was used to evaluate changes in case mix severity and changes in disease/stage specific ALOS for both the PSRO concurrent review and the comparison hospitals. It was found that:

- For 8 of the 9 diagnoses in which hospitalization is not always necessary at Stage I there was a decrease in the proportion of Stage I patients, implying an increase in the severity level for both PSRO concurrent review and comparison hospitals. However, in 5 of the 8 diagnoses the decreases were statistically significant for the PSRO concurrent review hospitals, whereas for the comparison hospitals only 2 of the 8 were significant. PSRO concurrent review hospitals also showed decreases in the proportions of Stage I patients for 8 of the 14 diagnoses in which hospitalization is indicated at Stage I, while comparison hospitals showed decreases in the proportions of Stage I patients for 9 of the 14 diagnoses. These results are especially interesting in light of observed overall decreases in ALOS, implying a general trend of decreased lengths of stay at the same time that the diagnosis-specific severity was increasing. (Section 5.7.1)

- The analysis of stage specific ALOS produced inconclusive results. For some diseases with decreasing ALOS consistent decreases were found for all stages of that disease while for other diagnoses the changes in ALOS varied as a function of disease severity, implying that PSRO concurrent review may have a different impact on patients at different severity levels of a given diagnosis. (Section 5.7.2)

- Based on changes in staging case mix between the post and pre periods, the overall ALOS would have been a little over 1% higher in the post period for both PSRO concurrent review

and comparison hospitals for the 9 diagnoses for which hospitalization is not always necessary at Stage I. This result is consistent with the general increase in severity levels already observed for these 9 diagnoses as a group. (Section 5.73)

- There was a secular decrease in stage-specific adjusted ALOS for both groups of hospitals and for both diagnosis groups. However, while the decrease in stage-specific adjusted ALOS was approximately 3% greater in the comparison hospitals for the 9 diagnoses for which hospitalization is not always necessary at Stage I, the reverse was true for the 14 diagnoses for which hospitalization is usually indicated at Stage I (almost a 2% greater decrease for PSRO concurrent review hospitals). These results would tend to indicate that PSRO concurrent review had a differential ALOS impact based on diagnosis type (appropriateness of early hospital admission) and stage of severity. (Section 5.7.3)

1.2.2 Medicaid Findings

Using the same pre/post regression model as was applied for the Medicare sample, it was found that:

- As was the case for Medicare, both PSRO concurrent review and comparison hospitals experienced a secular decrease in ALOS adjusted for patient mix for Medicaid patients. However, in contrast to the Medicare results, the decrease for the PSRO concurrent review Medicaid hospitals was approximately .2 days smaller than the decrease experienced by the comparison hospitals. (Section 6.2.2) Because this result, too, was statistically significant, the

Medicaid findings are in conflict with those for the Medicare sample where the PSRO review hospitals outperformed the comparison hospitals by reducing adjusted ALOS by about .2 days.

- The results of the analysis for 21 selected diagnosis groups revealed that the PSRO concurrent review activities usually did not have the intended effect of reducing adjusted ALOS in the PSRO concurrent review hospitals relative to the comparison group. Indeed, the results were mixed, with two diagnoses (Cholecystitis/Choletithiasis and Cerebrovascular Disease) exhibiting statistically sigificant net reductions and two others (urinary tract infection and diabetes) significant net increases in the adjusted ALOS. (Section 6.2.3).

An analysis of adjusted ALOS for the Medicaid sample was also performed using several hospital, geographic, and PSRO characteristics. If was found that:

- Simultaneously controlling for the independent variables did not change the results of the primary Medicaid ALOS analysis which showed that the PSRO concurrent review hospitals experienced a decrease in ALOS of .20 days less than the decrease for the comparison hospitals. With the independent variables accounted for, the comparable net difference between the hospital groups was .21 days. (Section 6.2.2)
- Examination of the hospital teaching status variable indicated that comparison teaching hospitals achieved significantly greater reductions in ALOS than PSRO concurrent review teaching hospitals.

In addition, this differential was significantly greater than the differential observed between comparison and PSRO concurrent review non-teaching hospitals. (Section 6.2.4)

- For hospitals located in counties with low short term bed/population ratios, the comparison hospitals performed significantly better than the PSRO concurrent review hospitals, while in areas with high bed to population ratios no significant differences were observed between the two groups. (Section 6.2.4)

When the analysis was focused on the relative impact of delegation status on adjusted ALOS, it was found that:

- The secular decrease in ALOS was greater in the comparison hospitals than in either the delegated or the non-delegated PSRO concurrent review hospitals. However, only the difference between comparison hospitals and delegated PSRO concurrent review hospitals was statistically significant. (Section 6.2.5) This finding supports the results of the Medicare analysis in implying that PSRO concurrent review is more effective in non-delegated than in delegated hospitals.

An analysis of the distribution of length of stay for Medicaid patients was also performed with the following results:

- Both PSRO concurrent review and comparison hospitals experienced an increase in the percent short stays and a decrease in the percent long stays for Medicaid patients. This finding

is consistent with the secular pre-post decrease observed for ALOS in that it is indicative of a downward shift in the distribution of length of hospital stays. (Section 6.3.2)

- A decrease of 4.3% in the percent long stays was observed for the PSRO concurrent review hospitals, and a decrease of 4.0% for the comparison hospitals; however, the difference (.3%) was not statistically significant. (Section 6.3.2) This finding is not in agreement with the Medicare results where a significantly greater decrease in the percent long stays was observed for the PSRO concurrent review group.

- The percent short stays increased by .27% in the PSRO concurrent review hospitals and by .15% in the comparison hospitals; however, the difference (.12%) was not statistically significant. (Section 6.3.2) This finding is in agreement with the Medicare results where again no significant difference was found.

When the LOS distribution analysis was performed for each of the 21 diagnosis groups it was found that:

- Significant secular decreases in percent long stay were observed in 10 diagnosis groups for PSRO concurrent review hospitals, and in 3 of the 10 (Cholecystitis/Choletithiasis, Hyperplasia Prostate, and Cerebrovascular Disease) the decrease was significantly greater in the PSRO concurrent review than in the comparison hospitals. (Section 6.6.3) This finding contrasts with the Medicare results where none of the diagnosis-

specific decreases in percent long stays were significantly greater for the PSRO concurrent review hospitals.

- Only one diagnosis group (Carcinoma of the Breast) showed a significant increase in the percent of short stay Medicaid patients for the PSRO concurrent review hospitals relative to the comparison hospitals. (Section 6.3.3)

As in the Medicare analysis, the analysis of changes in diagnostic mix, admissions, and total days of care for the Medicaid sample was severely limited by the lack of eligibility data. However, based on a limited analysis it was found that:

- Hypertrophy Tonsils and Adenoids, Urinary Tract Infection, Ulcer, and Cholecystitis/Choletithiasis experienced statistically significant reductions pre to post, in the proportions of patients in PSRO concurrent review hospitals, while Delivery and the "other" category experienced significant increases. (Section 6.4)

- When ALOS was adjusted for case mix, none of the observed changes in ALOS could be attributed to changes in mix of diagnoses for either hospital group. Therefore, observed overall changes in ALOS were apparently due to actual changes in the ALOS for the specific diagnosis groups rather than changes in the diagnostic mix itself. An overall secular decrease in the diagnosis-specific adjusted ALOS was observed, however; and, in support of the major Medicaid finding, the decrease was greater in the comparison hospitals than in the PSRO concurrent review hospitals. (Section 6.4)

- The ratio of PSRO concurrent review hospital admissions to total admissions decreased significantly by 3.0% from pre to post. A similar ratio calculated for days of care also showed a significant reduction of 2.0% from pre to post. The changes noted for the Medicaid sample were somewhat greater than those for the Medicare sample. Although these changes are consistent with the hypothesis that PSRO review had the effect of reducing the admission rate and hospital days of care rate, the lack of eligibility data makes this finding extremely tentative. (Section 6.5)

From the analysis of the CPHA LSS program exclusions for Medicaid patients, it was found that:

- Only a small proportion of patients (approximately 4% for the PSRO review hospitals and 5% for comparison hospitals) were excluded from the Medicaid analysis as compared to almost 20% in the Medicare analysis. There was almost no change in the proportion of excluded patients from pre to post within each hospital group for any of the exclusion categories. (Section 6.6)
- ALOS for patients excluded from both the PSRO concurrent review hospitals and comparison hospitals declined from pre to post; however, the decline for PSRO hospitals was greater (1.74 days) than for the comparison hospitals (.28 days). The ALOS for transfers declined more in the comparison hospitals (1.66 days) than in the PSRO concurrent review hospitals (.85 days). The reverse was found for stays over

100 days where PSRO concurrent review hospitals decreased the ALOS by 17 days versus 5.7 days for the comparison hospitals; however, the number of patients in this category was extremely small. The ALOS for patients who died increased by approximately 1.3 days for each hospital group. (Section 6.6)

- Because of the small proportion of Medicaid patients excluded and the relatively small overall changes in ALOS for the excluded patients, the inclusion of these patients in this analysis would not have affected the evaluation findings for the Medicaid sample. (Section 6.6)

A staging analysis of disease severity was performed for Medicaid patients. It was observed that:

- While a significant shift toward a more severe case mix was observed for the PSRO concurrent review hospitals, the shift, although in the same direction, was of lower magnitude and not statistically significant for the comparison hospitals. While a lack of eligibility data makes a definitive interpretation impossible, these findings are extremely interesting in light of the results of the primary analysis of changes in ALOS and may indicate that at least part of the apparently poorer performance by the PSRO concurrent review hospitals resulted from the fact that the patients in these hospitals were generally more seriously ill than in the comparison hospitals. (Section 6.7.1)

- Based on changes in staging case mix between the post and pre periods, the overall ALOS would have been a little over 5% higher in the post period for the PSRO concurrent review hospitals and about 2% lower for the comparison hospitals for the 9 diagnoses for which hospitalization is not always necessary at Stage I. This result is consistent with the general increase in severity levels observed previously for these diagnoses in the PSRO concurrent review hospitals. (Section 6.7.3)

- There was a secular decrease in stage-specific adjusted ALOS for both groups of hospitals and for both diagnosis groups. However, for the 9 diagnoses for which hospitalization is not always necessary at Stage I, the comparison hospitals experienced a 2% greater net reduction in adjusted ALOS than did the PSRO concurrent review hospitals, while the reverse was true for the 14 diagnoses for which hospitalization is indicated at Stage I. (The PSRO concurrent review hospitals had a 5% greater net reduction in adjusted ALOS.) For Medicaid, therefore, the PSRO concurrent review hospitals performed better for diagnoses for which hospitalization is usually indicated at Stage I and worse for the diagnoses for which hospitalization is not always necessary at Stage I. This finding is consistent with the results for Medicare: PSRO concurrent review had a differential ALOS impact based on diagnosis type (appropriateness of early admission) and stage of severity. (Section 6.7.3)

- Overall changes in ALOS for a given diagnosis appear not to be consistent across the three severity stages. Less consistency was found across the stages than was the case for Medicare patients, perhaps resulting from the greater range of age in the Medicaid population. Whatever the cause, however, this finding indicates an interaction between disease severity and PSRO concurrent review effectiveness that should be considered in future evaluation efforts. (Section 6.7.2)

1.3 ORGANIZATION OF THE REPORT

Major evaluation issues addressed in this study are described briefly in Section 2. The study methodology including overall design and analytical techniques employed is described in Section 3. Section 4 provides a description of the Hospital Discharge Abstract Data Base used in the evaluation including sample plan, data sources, and an assessment of the representativeness of the sample. Findings of the analysis are included in Section 5 for the Medicare sample and in Section 6 for Medicaid. Each of these sections contain contains an analysis of ALOS, LOS distribution, admissions, days of care, diagnostic mix, and severity of illness.

2. MAJOR EVALUATION ISSUES

The primary purpose of this project was to analyze the impact of PSRO concurrent review on hospital utilization. The analysis was performed using the Hospital Discharge Abstract Data Base described in Section 4. Before outlining the major issues addressed in the study it is necessary to point out a major constraint on the project that limited the types of analyses undertaken. Specifically, no eligibility data for either the Medicare or Medicaid populations were available for this study. This lack of "denominator" data precluded use of population-based effectiveness measures such as total days of care per 1000 population or number of admissions per 1000 population. Our analysis therefore concentrated on hospital stay characteristics; namely, Average Length of Stay (ALOS), % Long Stays, and % Short Stays. Also examined were changes in diagnostic mix, changes in severity of illness and changes in patient transfer rates. Outlined below are the major issues addressed in this study.

ISSUE 1: Has ALOS changed as a result of PSRO activities?

Average length of stay (ALOS) was compared for periods prior to and subsequent to the initiation of PSRO review. The changes in ALOS observed for concurrent review hospitals were compared to ALOS changes in comparison hospitals over the same time period to attempt to account for trends in ALOS that may have occurred independent of the PSRO program. In addition to reviewing the changes in ALOS for all discharges, changes in ALOS for individual diagnosis groups were analyzed. Because it is possible that changes in length of stay are affected by PSRO review characteristics (e.g., delegation status), hospital characteristics (e.g., bed size, occupancy rate), and area characteristics (e.g., ECF beds/population), an analysis of the relationship of these variables to the effectiveness of PSRO review was included in the study.

ISSUE 2: Has the distribution of stay changed as result of PSRO activities?

To supplement the analysis of ALOS, an evaluation was performed of the effect

of PSRO review on % "short" and % "long" stay patients. This analysis paralleled the ALOS evaluation including review of overall impacts and impacts on selected diagnosis groups.

ISSUE 3: Has the diagnostic mix and/or the mix of severity changed as a result of PSRO review?

In addition to changes in LOS distribution that may result from PSRO activities, PSRO review may also impact on patient mix both between diagnoses and on illness severity within diagnoses. While the data available for this study did not allow the determination of what specific behavioral factors might have led to observed changes in patient mix, an analysis of these changes was performed to attempt to identify areas where further study may be warranted.

ISSUE 4: Has the admission rate changed as a result of PSRO review?

ISSUE 5: Has the days of care/population ratio changed as a result of PSRO review?

Neither of these issues can be addressed fully in this study because of a lack of eligibility data needed to determine admission rates or days of care per 1000 population. Therefore, although summary tables of the number of admissions and the total days of care were produced, it was not possible to determine if observed changes resulted from PSRO impact on hospital utilization or from changes in either eligibility statistics or hospital catchment populations.

ISSUE 6: Has the proportions of transfers, stays over 100 days, or deaths changed as a result of PSRO review?

Transfers, patients with stays over 100 days, deaths and patients with age, discharge status or stay unrecorded were excluded from the CPHA LSS Program and, therefore, from our primary analysis. However, a separate analysis was performed to evaluate PSRO impacts on these patient categories, and how the exclusion of these patients affected the results of the primary analysis.

3. METHODOLOGY

3.1 STUDY DESIGN

Given the extreme time constraint under which this project was conducted, it was necessary to make a number of simplifying assumptions which would facilitate the statistical analyses. Because the major objective was to measure the impact on various utilization variables of concurrent review activities, the variables of interest were reduced to their most elemental forms. Since we are concerned about the performance of the concurrent review (or experimental) hospitals relative to the comparison (or control) hospitals, a variable measuring the type of study hospital was formed. This variable (denoted as STYPE throughout the report) was of the binary type in that it assumed a value of zero for concurrent review hospitals and a value of one for comparison hospitals. Similarly, we defined a "pre" period of time before concurrent review commenced, and a "post" period following concurrent review. Again, a binary variable (denoted as TIME throughout the report) was defined such that it took on a value of zero in the pre-concurrent review period and a value of one in the post period.

Using such variables to measure the impact of concurrent review will, of course, ignore a considerable amount of information available in the study sample. For example, the concurrent review hospitals are not homogeneous since they vary by size, occupancy, rate, ownership, location, delegation status, etc. And it may very well be that some types of hospitals were more successful in implementing concurrent review than others. However, our first consideration was to attempt to measure the overall, i.e. total, impact of concurrent review

activities. The strategy was, therefore, to attempt to measure any gross effect and to consider such second-order effects as research questions to be answered by more refined techniques. Moreover, the philosophical question must be posed as to whether it makes sense to consider concurrent review to be efficacious if it had an impact on only a subset of hospitals. The same holds true with the time variable. While it would be interesting to measure the speed with which concurrent review activities began to be measurable, we are concerned foremost with whether or not there was any impact to be measured. Moreover, as is described below, the time interval available for observation following the initiation of concurrent review was extremely limited for the bulk of the concurrent review hospitals, and, thus, it is not feasible to attempt to measure any time response characteristics with the limited information available.

In summary, our primary objective was to address the fundamental question: was there any additional change in hospital utilization rates between the pre- and post concurrent review periods for the concurrent review hospitals relative to the comparison hospitals? In order to answer this question, the study was designed to control for a number of patient and hospital variables in order to isolate the independent effect of concurrent review.

3.1.1 Unit of Observation

Because of the large data base and limited time available for this project, it was necessary to define an alternative unit of observation other than individual patients, and to use this unit as the basis for the analyses. While the definition of a unit of observation is largely

internal to the structuring of the data base, it did impact on the potential analyses that can be performed. The alternative units of observation considered for the analysis were the hospital and the patient. In the analysis of the data base, both are used depending on the objective of the specific analysis that was undertaken.

For the majority of the analysis, the hospital was selected as the primary unit of observation which was further subclassified by payment category, diagnosis group, and quarter of discharge (3 pre and 3 post quarters). Payment category, diagnosis group and quarter of discharge variables are described later in this section.

Using the hospital as the primary unit of observation had a number of advantages. Most importantly it reduced the size of the data base that was manipulated from 1,189,809 "patient" observations to 13,382 Medicare and 8,568 Medicaid "hospital, diagnosis group, and pre/post discharge quarter" observations. (Medicare: 137 hospitals x 22 diagnoses x 6 quarters = 18,084 hospital-diagnosis-quarter observations. 4,702 of these "cells" were empty--no patients in the cell--leaving 13,382 Medicare observations. Medicaid: 128 hospitals x 22 diagnoses x 6 quarters = 16,896 observations, 8,328 of which were empty, leaving 8,568 Medicaid hospital-diagnosis-quarter observations. These are the observations used in most of the regressions discussed in Chapters 5 and 6.) At the same time, it allowed the linkage of the utilization data to the Hospital Data File, thereby providing the flexibility for determining differences in utilization as a function of PSRO review characteristics (e.g., delegation status), hospital characteristics (e.g., bed size, occupancy rate), and catchment area characteristics (e.g., extended care beds/1000 population). This unit of observation was used by CPHA in the LSS Program. The output of that program, including Average Length of Stay, Expected Length of Stay for Matching Patients, and % Long and % Short Stay patients for a given hospital and diagnosis group, provided the utilization statistics upon which our analyses were based.

The staging analysis of the severity of illness, however, used the patient as the unit of observation, since the objective was to examine the distribution of patients at various stages of disease for selected diagnoses.

It is important to stress that while the "hospital" was a basic unit of observation for purposes of structuring the data base, confidentiality constraints precluded the release of any information that could be related to an individual hospital. All utilization statistics provided as output of this project were summarized in a manner that masked the identity of individual hospitals.

3.1.2 Time Period Definitions (Pre-Post)

The data base included patient discharges for 11 quarters: January 1974 through September 1976. As described in Section 4 of this report, there were some data missing from hospitals in the last few months of this time frame. Of the 95 concurrent review hospitals that participated in the data base development activity, three were excluded from the final sample because of missing data considerations, and one hospital had Medicaid patients only. The remaining 91 concurrent review hospitals included in the data base for the Medicare analysis started concurrent review within the 5 quarter period from 4th quarter 1974 to 4th quarter 1975. Similarly, 15 hospitals were excluded for the Medicaid analysis because binding Title 19 review was not started at all or began after the 1st quarter of 1976. The distribution of quarter in which binding Title 18 review and binding Title 19 review began is shown below:

YEAR	1974				1975				1976			TOTAL
QUARTER	1	2	3	4	1	2	3	4	1	2	3	
Number of Participating hospitals starting:												
Title 18 review	-	-	-	6	-	9	21	55	-	-	-	91
Title 19 review	-	-	-	4	-	6	17	50	-	-	-	77

Based on this distribution it was decided to define the "Pre-Review" period as the first three quarters of 1974 and the "Post-Review" period as the first three quarters of 1976. This definition of Pre and Post had a number of advantages:

- The Pre and Post periods included the same number of quarters.
- The part of the year covered by Pre and Post periods was the same, thereby eliminating the impact of seasonal changes in hospital utilization.
- It is very difficult to define a specific "start" date for concurrent review. By defining Pre and Post in the manner described above, disequilibrium conditions resulting from planning and implementation activities were minimized, thereby allowing a clearer analysis of the changes in utilization resulting from PSRO concurrent review.
- Although the Pre-Post period definition excluded from the analysis the utilization patterns from the 4th quarter of 1974 and all four quarters of 1975, the approach maximizes the number of concurrent review hospitals retained for the analysis. The sample of 51 comparison hospitals were, of course, available for the analysis for any period or subperiod selected.

It was recognized that the hospitals that began concurrent review earlier in the period may differ in utilization patterns and hospital characteristics from the institutions that began review in late 1975. Therefore, cohorts of hospitals by beginning date of review were examined separately to augment the primary Pre-Post comparisons. However, the majority of the analyses performed concentrated on differences in hospital utilization Pre and Post. All statistical significance testing and regression analysis performed as part of the study were done using the Pre and Post definitions. However, quarterly data were maintained for all 11 quarters and overall changes in utilization displayed on a quarter by quarter basis.

3.1.3 Diagnosis Groups

It was expected that concurrent review may have had a different impact on patients with different diagnoses. To analyze this impact, 21 diagnosis groups (plus an "other" category) were used in the study. These groups were taken from the PSRO Evaluation Plan[1] and have been selected by the National PSRO Council as useful diagnoses for evaluation of PSRO impact. Minor modifications were made to the group definitions in order to make them correspond to the CPHA List A groups and the H-ICDA-2 coding system. The list of diagnosis groups (and their corresponding H-ICDA-2 codes) used in this project is shown in Table 3.1.

3.1.4 Patients to be Included in the Analyses

For the Medicare and Medicaid analyses, it was decided to eliminate from consideration certain patient discharges that had been included in the original data base of 1,336,167 discharges. Newborns, Medicare eligibles under age 65, and Title V discharges were not included in the analysis. This served to reduce the size of the total data base as follows:

		# of Discharges		% of All Discharges
Original Data Base		1,336,167		100.0%
Newborn	63,353		4.7%	
Title V	6,036		0.5%	
Medicare Under Age 65	77,789		5.8%	
SUBTOTAL NOT INCLUDED		147,178		11.0%
Net Data Base		1,189,809		89.0%

It was also decided to perform separate analysis for the Medicare and Medicaid populations. The remaining 1,189,809 discharges, therefore, had to be split into these two categories. This classification was not a problem when the

Table 3.1

DIAGNOSIS GROUPS AND CORRESPONDING H-ICDA-2 CODES

DIAGNOSIS GROUP	DIAGNOSIS DESCRIPTION	CPHA LIST A GROUP	H-ICDA-2 CODES
1	Hypertension	128,129	400.0-401 403-404 402
2	Pneumonia	157	480-486
3	Heart Failure	135	427.0, 427.1 782.4
4	Urinary Tract Infection	196, 197, 202	590.1 590.0, 590.2-590.9 595
5	Ulcer	172, 173 174, 175	531.9 531.0-531.2 532.9, 533.9, 534.9 532.0-532.2 533.0, 534.0-534.2
6	Cholecystitis/ Choletithiasis	191	574.0-574.9 575, 576.9
7	Inguinal Hernia	181	550
8	Hyperplasia Prostate	205	600
9	Disc, Displacement	265 266	725.1 725.0, 725.8-725.9
10	Complications and Adverse Reactions	333, 334, 335 338, 339	965.0-965.9 967.0-967-9 960.0-964.9 966.0-966.9 968.0-979.4 997-998.9 999.0-999.1 999.3-999.9

DIAGNOSIS GROUP	DIAGNOSIS DESCRIPTION	CPHA LIST A GROUP	H-ICDA-2 CODES
11	Cerebrovascular Disease	137, 138, 139, 141	430.0-430.9 432.0-432.9 435.0-439.9 431.0-431.9 433.0-434.9 436.0-438.9
12	Chronic Ischemic Heart Disease	132	411.0-412.9 414.0-414.9
13	Acute Myocardial Infarction	130	410
14	Diabetes	67, 68	250.9, 250.0
15	Malignant Neoplasm of Breast	28	174
16	Delivery	232 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249	650, 651.0 651.1 652 653 655 656.0 656.1-656.9 657.1 654.0-654.9 657.2-657.9 658.0 658.1-658.9 659-660.9 657.0 661.3 661.0 661.2 651.9, 661.1
17	Hypertrophy Tonsils & Adenoids	163	500
18	Fracture of Femure	306	820.0-820.9
19	Cataract	116 117	374.9 374.0-374.9
20	Neuroses	93 94 95	300.0 300.4 300.1-300.3 300.5-302.9

DIAGNOSIS GROUP	DIAGNOSIS DESCRIPTION	CPHA LIST A GROUP	H-ICDA-2 CODES
21	Appendicitis	179	540.0
		178	540.9-541
22	Aggregate of remaining List A groups.		

"expected payment source" was recorded as either Medicare or Medicaid; however, when more than one payment source was indicated a decision needed to be made as to how to categorize these patients. The decision rules that were used in assigning patients to the Medicare and Medicaid categories are given below:

Expected Payment Source (from Patient Abstract)	Category for this Study	# of Patients
Medicare only	Medicare	719,729
Medicare/Medicaid (and age >65)	Medicare	56,019
Medicare/Title V (and age >65)	Medicare	98
Medicaid Only	Medicaid	402,387
Medicare/Medicaid (and age <65)	Medicaid	11,498
Medicaid/Title V	Medicaid	78

Thus, the data base used for this study consisted of 775,846 Medicare patient discharges and 413,963 Medicaid patient discharges.

3.1.5 CPHA LSS Program Output

CPHA's Length of Stay Study (LSS) program was used to provide certain information on the Expected Length of Stay (ELOS) for all patients in this study. The primary purpose of the LSS proprietary software at CPHA is to provide regional and national LOS norms on a monthly, quarterly, and semi-annual basis to hospitals participating in CPHA's Professional Activity Study (PAS). PAS hospitals can then compare their utilization statistics to these norms.

The CPHA 1975 PAS data base with approximately 15.4 million discharges from 1887 PAS hospitals in the U.S. was the reference population for matching patients used by the LSS in this project. LSS, using this base, calculated the mean ELOS for each studied patient (i.e., the ALOS of all matching patients), and determined if the studied patient's observed length of stay was in the lower 5% or upper 25% of their matching patients' distribution. Specifically, each studied patient was classified into a cell based on the patient's CPHA List A diagnosis group, whether the patient had single or multiple diagnoses, patient's age (0-19, 20-34, 35-49, 50-64, 65+), and whether the patient was operated or not operated. The ELOS assigned to each patient was based on the ALOS from all the 1975 PAS data base patients in the appropriate U.S. census region falling in the same cell. Table 3.2 presents a sample page of the length of stay norms from a CPHA publication which formed the basis of the ELOS computation. It should be noted that PSROs frequently use these length of stay norms in their review functions.

Studied patients were separated into two files--Medicare and Medicaid. In each file patients were aggregated into cells by hospital, by OPEL diagnosis group (23 groups = 21 OPEL groups plus 1 group for all other diagnoses, plus 1 group which included all patients), and by quarter (11 quarters). Finally, for each cell defined by quarter, diagnosis group, hospital, Medicare and Medicaid, the following variables were provided:

1. Hospital I.D. Code #
2. Diagnosis Group #
3. Year/Quarter Code
4. Total Patients Discharged
5. Number of Patients Studied
6. ALOS for Studied Patients
7. Average Expected Length of Stay ($\overline{ELOS}$) using regional norms

Table 3.2

Sample Page from CPHA Publication: Length of Stay in PAS Hospitals by Diagnosis, U.S., Southern Region, 1975

479 PAS Hospitals, January – December 1975

247: Delivery complicated by premature or prolonged rupture of membranes (664.0-664.1)

TYPE OF PATIENT (1)	TOTAL PATIENTS (2)	AVG. STAY (3)	VARIANCE (4)	PERCENTILES 5th (5)	10th (6)	50th (7)	75th (8)	90th (9)	95th (10)	99th (11)
1. SINGLE DX										
A. *Not Operated*										
0-19 YRS	711	3.5	3	2	2	3	4	5	6	8
20-34	2259	3.6	1	2	2	3	4	5	6	8
35-49	121	3.8	3	2	2	3	4	6	7	13
50-64										
B. *Operated*										
0-19 YRS	176	4.1	3	2	3	4	5	6	8	9
20-34	657	4.3	5	2	2	4	5	7	8	11
35-49	50	5.0	4	2	3	4	7	8	9	10
50-64										
2. MULTIPLE DX										
A. *Not Operated*										
0-19 YRS	365	3.8	3	2	2	3	4	6	6	11
20-34	1007	4.0	5	2	2	4	4	6	7	11
35-49	77	4.1	5	2	2	4	5	6	9	13
50-64										
B. *Operated*										
0-19 YRS	471	5.2	22	2	3	4	6	8	9	14
20-34	1994	5.4	15	3	3	5	6	8	10	17
35-49	215	6.4	10	3	3	6	8	10	12	19
50-64										
SUBTOTALS:										
1. SINGLE DX										
A. *Not Operated*	3091	3.6	2	2	2	3	4	5	6	8
B. *Operated*	883	4.3	5	2	2	4	5	7	8	10
2. MULTIPLE DX										
A. *Not Operated*	1449	3.9	4	2	2	4	4	6	7	11
B. *Operated*	2680	5.5	16	2	3	5	7	8	10	16
1. SINGLE DX	3974	3.7	3	2	2	3	4	5	6	9
2. MULTIPLE DX	4129	4.9	13	2	3	4	6	8	9	15
A. NOT OPERATED	4540	3.7	3	2	2	3	4	5	6	9
B. OPERATED	3563	5.2	14	2	3	4	6	8	9	15
TOTAL 0-19 YRS	1723	4.1	9	2	2	4	5	6	8	12
20-34	5917	4.3	8	2	2	4	5	7	8	13
35-49	463	5.2	8	2	3	4	7	9	10	15
50-64										
GRAND TOTAL	8103	4.3	8	2	2	4	5	7	8	13

248: Delivery complicated by previous cesarean section (664.4)

TYPE OF PATIENT (1)	TOTAL PATIENTS (2)	AVG. STAY (3)	VARIANCE (4)	PERCENTILES 5th (5)	10th (6)	50th (7)	75th (8)	90th (9)	95th (10)	99th (11)
1. SINGLE DX										
A. *Not Operated*										
0-19 YRS	4	3.0	1	2	2	3	4	4	4	4
20-34	27	3.6	4	1	2	3	4	7	8	9
35-49	3	4.0	7	2	2	3	6	7	7	7
50-64										
B. *Operated*										
0-19 YRS	438	6.2	2	4	5	6	7	8	8	10
20-34	3461	6.4	3	4	5	6	7	8	8	10
35-49	177	6.8	3	4	5	7	8	9	10	12
50-64										
2. MULTIPLE DX										
A. *Not Operated*										
0-19 YRS	6	5.5	8	2	2	5	8	9	9	9
20-34	13	3.8	3	2	2	3	6	6	7	7
35-49										
50-64										
B. *Operated*										
0-19 YRS	337	6.6	4	4	5	6	7	9	10	15
20-34	3751	6.9	9	5	5	7	8	9	10	17
35-49	297	7.7	21	5	5	7	8	9	12	31
50-64										
SUBTOTALS:										
1. SINGLE DX										
A. *Not Operated*	34	3.6	4	1	2	3	4	7	8	9
B. *Operated*	4076	6.4	3	4	5	6	7	8	9	10
2. MULTIPLE DX										
A. *Not Operated*	19	4.3	5	2	2	3	6	8	9	9
B. *Operated*	4365	7.0	9	5	5	7	8	9	10	17
1. SINGLE DX	4110	6.4	3	4	5	6	7	8	9	10
2. MULTIPLE DX	4404	7.0	9	4	5	7	8	9	10	17
A. NOT OPERATED	53	3.8	4	2	2	3	5	7	8	9
B. OPERATED	8461	6.7	6	4	5	6	7	8	9	14
TOTAL 0-19 YRS	785	6.3	3	4	5	6	7	8	9	12
20-34	7252	6.7	6	4	5	6	7	8	9	14
35-49	477	7.3	14	5	5	7	8	9	10	22
50-64										
GRAND TOTAL	8514	6.7	6	4	5	6	7	8	9	14

8. Number of patients with Short Stays (below 5th percentile stay)
9. Number of patients with Long Stays (above 75th percentile stay)

The $\overline{ELOS}$ is the arithmetic mean ELOS for studied patients in a given quarter, a given OPEL diagnosis group, and a given hospital.

The cut-offs for the 5th and 75th percentile stay were also taken from the PAS data base (matching patient base) mentioned above, stratified by the same cells as in the ELOS computation.

The Length of Stay Study program routine excludes the following specific types of cases:

- Transfers
- Patients with stays over 100 days
- Deaths
- Patients with unrecorded age, discharge status, or length of stay

These exclusions reduced the total number of patients included in the study; however, assessments of the differences between aggregate utilization characteristics for all patients discharged and the patients included in the study are discussed in Section 5 (Medicare) and Section 6 (Medicaid).

3.2 ANALYTICAL TECHNIQUES

Multiple linear regression techniques using binary variables were the principal methods of statistical analyses. The ordinary least square technique was modified in accord with well-accepted statistical methods to fit the special requirements for hypothesis testing in the study. The resultant models, which are equivalent to analysis of variance, offer simple, yet versatile methods to test many complex hypotheses.

3.2.1 Basic Regression Model

Since the principal hypothesis was to determine whether or not concurrent review hospitals had experienced a greater decline in ALOS from pre- to post- period relative to the comparison hospitals, the basic regression model was formulated in terms of binary variables as follows:

$$ALOS = \beta_0 + \beta_1 \, STYPE + \beta_2 \, TIME + \beta_3 \, S{\cdot}T + \varepsilon \, ,$$

where

ALOS = Average Length of Stay

STYPE = 0 for a Concurrent Review Hospital

STYPE = 1 for a Comparison Hospital

TIME = 0 for the Pre-Concurrent Review Period

TIME = 1 for the Post-Concurrent Review Period

S·T = STYPE x TIME (A cross-product or interaction term)

ε = the Stochastic Error Term

β_0, β_1, β_2, β_3 = Regression Parameters (to be estimated)

As usual, it was assumed that $E(\varepsilon) = 0$, i.e., that the expected value (mean) of the unobserved error term is zero for all observations. If so, it is readily apparent that:

$E(ALOS \mid STYPE = 0, TIME = 0) = \beta_0 = \mu_{00} \equiv \overline{ALOS}$ for Concurrent Review Hospitals in the Pre Period

$E(ALOS \mid STYPE = 1, TIME = 0) = \beta_0 + \beta_1 = \mu_{10} \equiv \overline{ALOS}$ for Comparison Hospitals in the Pre Period

$E(ALOS \mid STYPE = 0, TIME = 1) = \beta_0 + \beta_2 = \mu_{01} \equiv \overline{ALOS}$ for Concurrent Review Hospitals in the Post Period

$E(ALOS \mid STYPE = 1, TIME = 1) = \beta_0 + \beta_1 + \beta_2 + \beta_3 = \mu_{11} \equiv \overline{ALOS}$ for Comparison Hospitals in the Post Period

where $\overline{ALOS}$ denotes E (ALOS), or the mean ALOS for all hospitals having certain characteristics.

From these four equations it is easy to show that

$\beta_1 = \mu_{10} - \mu_{00} = \overline{ALOS}\ (\tilde{CR}) - \overline{ALOS}\ (CR)$ in the Pre Period or, in order to simplify the notation:

$\beta_1 = \mu_{10} - \mu_{00} = \Delta\ \overline{ALOS}\ (\tilde{CR}\text{-}CR \mid PRE)$.

Where CR denotes the concurrent review hospitals and $\tilde{CR}$ denotes the comparison hospitals.

Similarly,

$\beta_2 = \mu_{01} - \mu_{00} = \Delta\ \overline{ALOS}\ (POST\text{-}PRE \mid CR)$.

Or in words, β_1 is the difference in mean ALOS between the comparison hospitals and the concurrent review hospitals in the pre period, while β_2 is the change in mean ALOS between the post and the pre periods for the concurrent review hospitals. (It may also be of interest to compute

$\beta_2 + \beta_3 = \mu_{11} - \mu_{10} = \Delta\ \overline{ALOS}\ (POST\text{-}PRE \mid \tilde{CR})$,

i.e., the change in mean ALOS between post and pre periods for the comparison hospitals.) Using the same techniques, it is easy to show that

$\beta_3 = (\mu_{11} - \mu_{10}) - (\mu_{01} - \mu_{00})$

or

$\beta_3 = \Delta\ \overline{ALOS}\ (POST\text{-}PRE \mid \tilde{CR}) - \Delta\ \overline{ALOS}\ (POST\text{-}PRE \mid CR)$.

Thus, the β_3 regression parameter is the principal focus of the study since it measures the relative change in $\overline{ALOS}$ over time between the comparison and concurrent review hospitals. If PSRO concurrent review activities had an impact in lowering lengths of hospitalization, we would expect (in

an era of generally declining ALOS) that the Δ ALOS would decrease more for concurrent review versus comparison hospitals. That is, assuming a secular decrease in $\Delta \overline{\text{ALOS}}$, we expect that both $\Delta \overline{\text{ALOS}}$ terms in the expression for β_3 above will have negative values, but that the right-most term (for CR hospitals) will be more negative. If so, we would expect that β_3 would be more positive. The principal null hypothesis can then be expressed as

$$H_0: \beta_3 = 0 \quad \text{versus} \quad H_1: \beta_3 \neq 0$$

Thus, it is simply a matter of testing the significance of a single estimated regression coefficient using its t value in order to test the major structural hypothesis of the study, i.e., did PSRO concurrent review activities cause a decrease in average lengths of stay in excess of what would have been observed in the absence of such activities.

3.2.2 Accounting for Differences in Patient Mix

With this basic regression model in hand, it is easy to modify it in a number of ways to make it more appropriate to use with the sample data First, we note that there may be differences in the mixes of patient risk within diagnostic categories between hospitals and over time. Adjusting for such differences can be accomplished by including CPHA's expected length of stay (ELOS) variable in the basic regression model. The ELOS variable is computed for each observation (hospital) using individual patient characteristics (age, CPHA List A diagnosis, single or multiple diagnosis and operated or not operated) in such a way as to reflect the average length of stay expected for that hospital based on the individual patient characteristics and a set of reference stays derived from a large population. (See Section 3.1.5.) The revised regression model then becomes:

$$ALOS = \beta_0 + \beta_1 \text{ STYPE} + \beta_2 \text{ TIME} + \beta_3 \text{ S}\cdot\text{T} + \beta_4 \text{ ELOS} + \varepsilon.$$

The principal null hypothesis to be tested remains unchanged, i.e.,

$$H_0: \beta_3 = 0 \quad \text{versus} \quad H_1: \beta_3 \neq 0$$

It may also be of interest to observe how well the ELOS variable serves in predicting ALOS. If the study sample of hospitals comprises a random sample from the population on which the reference stays are based, we would expect that β_4 would equal unity, i.e., we may wish to test the null hypothesis

$$H_0: \beta_4 = 1.0 \quad \text{versus} \quad H_1: \beta_4 \neq 1.0.$$

If we cannot reject this null hypothesis, then we will have gained confidence concerning the validity of the ELOS adjustment mechanism for patient risk and have reason to believe that the study sample is representative of the total population. Moreover, if Ho above cannot be rejected, we would expect that the following regression model would be equivalent to the regression equation directly above:

$$A - E = \beta_0 + \beta_1 \text{ STYPE} + \beta_2 \text{ TIME} + \beta_3 \text{ S} \cdot \text{T} + \varepsilon.$$

where A - E = ALOS - ELOS.

Under this specification, we have returned to the basic regression model, but simply re-defined the dependent variable. It is probably less hazardous, however, to include ELOS as an independent variable since the ELOS computation is likely to be imperfect, especially for the Medicaid patients which are less homogeneous than Medicare patients. Therefore, it would be undesirable to artificially constrain to unity the β_4 parameter above.

Moreover, the value (relative to unity) of the estimated β_4 (in conjunction with β_0) will serve to indicate the validity of the ELOS computation as well as the representativeness of the study sample.

3.2.3 Generalized Least Squares

The next modification to the basic regression model involved the variation in number of patients per hospital. Because the ALOS variable is simply the mean length of stay for a particular hospital, its variance will not be constant between observations, and hence the conventional assumption of homoscedasticity between observations will be violated. That is, since the variance of a sample mean is σ^2/n (where n is the number of patients per hospital and σ^2 is the variance for the entire population), we expect the variance in the stochastic error term (ε) for the basic regression equation to vary as $1/n$; i.e., it is said to be heteroscedastic. It can be shown that, if ordinary least squares (OLS) regression techniques are applied under these conditions, the resulting estimated regression parameters will be unbiased, but inefficient. In order to gain efficiency (reduce the standard errors of the estimated coefficients) it is therefore desirable to apply generalized least squares (GLS) and account for the heteroscedasticity of the error term. If it is assumed that there is no interdependence between observations, as is likely the case between hospitals, then the variance-covariance matrix for the stochastic disturbance term is diagonal, with its elements proportional to $1/n$. Under such conditions it is easy to show that the GLS technique can be accomplished by applying OLS if the data are transformed as follows:

1. Multiply all variables in each observation by $\sqrt{n}$.

2. Suppress the conventional intercept term.

3. Use $\sqrt{n}$ as the new intercept "variable".

Because the conventional intercept term is no longer present, the R-square value computed for the transformed variables cannot be interpreted in the conventional manner as the fraction of the variance in the dependent variable explained by the model.

3.2.4 Utilization Measures Other than ALOS

In the above discussion, we defined Y as either ALOS - ELOS, or as ALOS with ELOS included as an independent variable on the right-hand side of the regression evaluation. However, Y could just as well be defined as the percent of those patients who stayed longer than 75% of the matching patients for a given diagnosis group in 1975, or, alternatively, as the percent of those patients who stayed a shorter time than 95% of the matching patients. Similarly, one could use the percent long stay and percent short stay patients as the dependent variable in the basic regression model discussed at the onset of this section. Again, the discussion concerning heteroscedasticity and generalized least squares (GLS) still applies.

In summary, the effects of PSRO concurrent review activities were measured in a weighted multiple regression model using the interaction (cross-product) term. The direction, magnitude, and level of statistical significance of the interaction term was of major importance in Sections 5 and 6 for the analysis of the impact of PSRO concurrent review on hospital utilization.

3.2.5 Interaction of Concurrent Review and Hospital Characteristic Variables

The final modification of the basic regression equation involves the influence of selected hospital characteristic variables on the relationship between ALOS, study type, and time. It is desirable to test the impact of such variables as teaching status, occupancy rate, number of short term beds, etc. on adjusted ALOS and on changes in adjusted ALOS. To do so, we may generalize the basic regression model as follows:

$$Y = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 (X \cdot STYPE)$$
$$\beta_5 (X \cdot TIME)+\beta_6 (STYPE \cdot TIME) +\beta_7 (X \cdot STYPE \cdot TIME)+\varepsilon$$

where, in addition to terms previously defined,

Y = ALOS corrected for ELOS, ALOS-ELOS, percent long stay patients, or percent short stay patients.

X = A hospital characteristic variable; as, for example, teaching status.

X•STYPE = A second-order interaction term.

X•TIME = A second-order interaction term.

X•STYPE•TIME = A third-order interaction term.

While X is usually a continuous variable, to aid in the interpretation of the coefficients, it will be dichotomized so that X has a value of zero when the added hospital characteristic is small in value or is absent, and a value of one when such a characteristic has a large value or is present. Following the procedure developed above, it can be shown that

$$\beta_1 = \mu_{100} - \mu_{000} = \Delta \bar{Y} \ (X-X|CR,PRE)$$

That is, for concurrent review hospitals in the pre-concurrent review period, the β_1 regression parameter measures the difference in the mean adjusted ALOS ($\Delta\bar{Y}$) between hospitals which have the characteristic in

question (X) and those which do not $(\tilde{X})$. In essence, β_1 measures whether or not ALOS is affected by the hospital characteristic variable X. Thus, if β_1 is found to be different than zero, we can conclude that the variable X is a determinant of ALOS, holding time and study type constant.

Similarly, it can be shown that

$$\beta_2 = \mu_{010} - \mu_{000} = \Delta\bar{Y}\ (\tilde{CR}\text{-}CR|\tilde{X},PRE).$$

That is, for hospitals in the pre period not having the attribute X, β_2 measures the difference in adjusted ALOS between comparison and concurrent review hospitals. And, by the same reasoning

$$\beta_3 = \mu_{001} - \mu_{000} = \Delta\bar{Y}\ (POST\text{-}PRE|\tilde{X},CR).$$

So that for concurrent review hospitals not having the attribute X, β_3 measures the change in the mean adjusted ALOS between the pre and the post periods.

In order to clarify the discussion which follows, let us assume that X measures, for example, hospital bed size. Further, for purpose of simplicity in exposition, let us assume that size is measured by a binary variable indicating whether a hospital has relatively few beds (X=0) or is relatively large in terms of bed size (X=1). The model will, of course, be equally valid with bed size as a continuous variable. However, the interpretation and explanation of the regression parameters then becomes more awkward to describe. Let us further refer to X=0 as "small" and X=1 as "large". Then we may summarize the above results as:

$$\beta_1 = \Delta\bar{Y}\ (LARGE\text{-}SMALL|CR,PRE)$$

$$\beta_2 = \Delta\bar{Y}\ (\tilde{CR} - CR|SMALL,\ PRE)$$

$$\beta_3 = \Delta\bar{Y}\ (POST\text{-}PRE|SMALL,CR)$$

Using the above notation, it can be shown that

$$\beta_4 = (\mu_{110} - \mu_{010}) - (\mu_{100} - \mu_{000})$$

or

$$\beta_4 = \Delta\bar{Y}\ (\text{LARGE-SMALL}|\tilde{\text{CR}},\text{PRE}) - \Delta\bar{Y}\ (\text{LARGE-SMALL}|\text{CR},\text{PRE})$$

That is, β_4 measures (in the pre period) whether or not the difference between in $\Delta\bar{Y}$ for large versus small hospitals was any different between the concurrent review and the comparison hospitals. Similarly,

$$\beta_5 = (\mu_{101} - \mu_{100}) - (\mu_{001} - \mu_{000})$$

or

$$\beta_5 = \Delta\bar{Y}(\text{POST-PRE}|\text{LARGE},\text{CR}) - \Delta\bar{Y}(\text{POST-PRE}|\text{SMALL},\text{CR})$$

Thus, β_5 measures for concurrent review hospitals whether or not the change in length of stay (between the pre- and post-review periods) was any different in large as compared to small hospitals. For example, if concurrent review activities were more effective in large hospitals, then β_5 would display a negative sign. In this light, β_6 is equally interesting:

$$\beta_6 = (\mu_{011} - \mu_{010}) - (\mu_{001} - \mu_{000})$$

or

$$\beta_6 = \Delta\bar{Y}(\text{POST-PRE}|\text{SMALL},\tilde{\text{CR}}) - \Delta Y(\text{POST-PRE}|\text{SMALL},\text{CR}),$$

i.e., for small hospitals, it measures the difference in the secular change in mean ALOS between the concurrent review and the comparison hospitals. In other words, β_6 tests for the effect of concurrent review on ALOS holding size (=SMALL) constant.

Finally, it can be shown that

$$\beta_7 = [(\mu_{111} - \mu_{110}) - (\mu_{011} - \mu_{010})] - [(\mu_{101} - \mu_{100}) - (\mu_{001} - \mu_{000})]$$

or

$$\beta_7 = [\Delta\bar{Y}\ (\text{POST-PRE}|\text{LARGE},\tilde{CR}) - \Delta\bar{Y}\ (\text{POST-PRE}|\text{SMALL},\tilde{CR}] - [\Delta\bar{Y}\ (\text{POST-PRE}|\text{LARGE},\text{CR}) - \Delta\bar{Y}(\text{POST-PRE}|\text{SMALL},\text{CR}].$$

The interpretation of β_7 is somewhat unwieldy to express precisely in words; nevertheless, it is accurate to say that β_7 measures whether the difference in the secular change in mean ALOS was greater in large versus small comparison hospitals as contrasted to large versus small concurrent review hospitals. However, it is also correct to say that β_7 measures whether or not the difference in the secular change in mean ALOS between comparison and concurrent review hospitals was dependent on hospital size.

It is also of interest to sum certain regression coefficients, for example:

$$\beta_5 + \beta_3 = (\mu_{101} - \mu_{100}) = \Delta\bar{Y}\ (\text{POST-PRE}|\text{LARGE},\text{CR})$$

and that

$$\beta_7 + \beta_5 = [(\mu_{111} - \mu_{110}) - (\mu_{011} - \mu_{010})]$$

or

$$\beta_7 + \beta_5 = [\Delta\bar{Y}(\text{POST-PRE}|\text{LARGE},\tilde{CR}) - \Delta\bar{Y}(\text{POST-PRE}|\text{SMALL},\tilde{CR})]$$

Similarly,

$$\beta_7 + \beta_6 = [\Delta\bar{Y}\ (\text{POST-PRE}|\text{LARGE},\tilde{CR}) - \Delta\bar{Y}\ (\text{POST-PRE}|\text{LARGE},\text{CR})]$$

This last equality is potentially quite interesting, since it measures the secular change in mean ALOS between concurrent review and comparison hospitals for those hospitals tending to be of a larger size (c.f., β_6 for smaller hospitals).

Other such combinations may be derived to test additional hypotheses which may be of interest. For example:

$$\beta_6 + \beta_3 = (\mu_{011} - \mu_{010}) = \Delta\bar{Y}(\text{POST-PRE}|\text{SMALL},\tilde{CR})$$

and

$$\beta_7 + \beta_6 + \beta_5 + \beta_3 = (\mu_{111} - \mu_{110}) = \Delta\bar{Y}\ (\text{POST-PRE}|\text{LARGE},\tilde{CR}).$$

The interpretation of this versatile, but somewhat complex, model can be facilitated by arranging the various regression parameters and sums of parameters in a matrix as shown in Table 3.3. Each element of the matrix contains the estimated value of the mean change in ALOS from the Pre to the Post periods, conditional on the row and column values associated with the element. For convenience we use the notation X to indicate a large value of the independent variable, whereas $\tilde{X}$ will indicate a small value. From the perspective of Table 3.4A it is clear that the estimated values for β_6 and for $\beta_6 + \beta_7$ are of major interest to this study. The combination of $\beta_6 + \beta_7$ measures the difference in the secular change in mean ALOS for large concurrent review versus large comparison hospitals, whereas β_6 alone measures an identical quantity for small hospitals.

Thus, the more complex regression equation involving second-order interaction terms is capable of estimating the magnitude of the PSRO effect while controlling for such hospital characteristics as bedsize. Moreover, by including a third-order interaction term, the coefficient β_7 indicates whether or not the PSRO effect varied as a function of the hospital characteristic measured by X. Thus, the level of significance of the estimated regression coefficient for β_7 reveals whether or not there was a differential PSRO effect dependent on the value of X; hence the value of β_7 therefore serves as a screening device when examining the estimation results for a number of distinct types of hospital characteristics.

Table 3.3

Components of $\Delta\bar{Y}$(Post-Pre) Conditional on Values of Hospital Characteristic Variable and on Concurrent Review vs. Comparison Status

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Variable to be Analyzed

Z_i = other 5 independent binary variables

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$	PSRO CONCURRENT REVIEW HOSPITALS: CR	COMPARISON-PSRO CONCURRENT REVIEW: $\tilde{CR}$-CR
X (e.g., large hospitals)	$\beta_7+\beta_6+\beta_5+\beta_3 =$ $\Delta\bar{Y}(\text{Post-Pre}/X,\tilde{CR}) =$ Mean change in ALOS for large control hospitals	$\beta_5+\beta_3 =$ $\Delta\bar{Y}(\text{Post-Pre}/X,CR) =$ Mean change in ALOS for large concurrent review (study) hospitals	$\beta_7+\beta_6 =$ $[\Delta\bar{Y}(\text{Post-Pre}/X,CR)]$ $-[\Delta\bar{Y}(\text{Post-Pre}/X,CR)]$ Difference in mean change in ALOS between large control and large study hospitals
$\tilde{X}$ (e.g., small hospitals)	$\beta_6+\beta_3 =$ $\Delta\bar{Y}(\text{Post-Pre}/\tilde{X},\tilde{CR}) =$ Mean change in ALOS for small control hospitals	$\beta_3 =$ $\Delta\bar{Y}(\text{Post-Pre}/\tilde{X},CR) =$ Mean change in ALOS for small concurrent review (study) hospitals	$\beta_6 =$ $[\Delta\bar{Y}(\text{Post-Pre}/\tilde{X},\tilde{CR})]$ $-[\Delta\bar{Y}(\text{Post-Pre}/\tilde{X},CR)] =$ Difference in mean change in ALOS between small control and small study hospitals
$X-\tilde{X}$ (e.g., large-small hospitals)	$\beta_7+\beta_5 =$ $[\Delta\bar{Y}(\text{Post-Pre}/X,\tilde{CR})]$ $-[\Delta\bar{Y}(\text{Post-Pre}/\tilde{X},\tilde{CR})] =$ Difference in mean change in ALOS between large and small control hospitals	$\beta_5 =$ $[\Delta\bar{Y}(\text{Post-Pre}/X,CR)]$ $-[\Delta\bar{Y}(\text{Post-Pre}/\tilde{X},CR)] =$ Difference in mean change in ALOS between large and small study hospitals	$\beta_7 =$ $\{[(\Delta\bar{Y}/X,\tilde{CR})-(\Delta\bar{Y}/X,CR)]$ $-[(\Delta\bar{Y}/\tilde{X},\tilde{CR})-(\Delta\bar{Y}/\tilde{X},CR)]\} =$ $\{[(\Delta\bar{Y}/X,\tilde{CR})-(\Delta\bar{Y}/\tilde{X},\tilde{CR})]$ $-[(\Delta\bar{Y}/X,CR)-(\Delta\bar{Y}/\tilde{X},CR)]\}$

In addition to measuring the differential effects of a single hospital characteristic variable on relative changes in ALOS, it is also desirable to simultaneously control for the impact of other hospital characteristic variables on the initial ALOS. That is, because the concurrent review and comparison hospitals are not based on matched samples, it is desirable to eliminate any effects of differences in the characteristic variables between the comparison and study hospital groups. Of course, the inclusion of the ELOS term in the regression equation should control for most of the differences. For example, teaching hospitals generally have longer stays because of a more severe case mix; however, the ELOS algorithm should also respond to such case mix differentials. Yet, in spite of the inclusion of the ELOS term, it can be anticipated that certain hospital characteristics will have an independent effect on ALOS, independent of any case mix effects; for example, teaching hospitals have been observed to have longer lengths of stay purely as a result of their teaching activities. Therefore, in order to guard against any effects due to sampling, a group of dichotomized hospital characteristic variables were included in the third-order interaction model so that the regression evaluation for ALOS is:

$$\text{ALOS} = \beta_0+\beta_1 X+\beta_2 \text{STYPE}+\beta_3 \text{TIME}+\beta_4 (X\cdot\text{STYPE})+\beta_5 (X\cdot\text{TIME})+\beta_6 (\text{STYPE}\cdot\text{TIME})+$$

$$\beta_7 (X\cdot\text{STYPE}\cdot\text{TIME})+\beta_8 \text{ELOS}+\sum_{i=9}^{13} \beta_i Z_i+\varepsilon$$

where, in addition to terms previously defined, we include five additional dichotomous hospital characteristic variables (Z_9 through Z_{13}).

In order to facilitate the interpretation of the model, the regression results using actual data are presented as an example in Table 3.4 and the results interpreted in light of the matrix elements presented in Table 3.3. The example is based on Medicare patients with the principal hospital characteristic variable (X) taken as the number of extended care beds per 1,000 population aged 65 and over in the county in which the hospital is located. For areas having at least

Table 3.4

Medicare ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\epsilon$

INDEPENDENT VARIABLE X = Extended Care Beds/1000 Pop. 65+ (in county)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 13382

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 46	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 91	$\tilde{CR}$ - CR
X: Extended Care Beds/1000 Pop. 65+ (in county) High: 1.5+ n = 42	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.30394$ P>F = 0.0156 n = 12	$\hat{\beta}_3+\hat{\beta}_5 = -0.88258$ P>F = 0.0001 n = 30	$\hat{\beta}_6+\hat{\beta}_7 = 0.57864$ P>F = 0.0002
$\tilde{X}$: Extended Care Beds/1000 Pop. 65+ (in county) Low: 0-1.49 n = 95	$\hat{\beta}_3+\hat{\beta}_6 = -0.67390$ P>F = 0.0001 n = 34	$\hat{\beta}_3 = -0.69157$ P>F = 0.0001 n = 61	$\hat{\beta}_6 = 0.01767$ P>F = 0.8722
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = 0.36996$ P>F = 0.0152	$\hat{\beta}_5 = -0.19101$ P>F = 0.0987	$\hat{\beta}_7 = 0.56097$ P>F = 0.0034

1.5 extended care beds per 1,000, X assumes a value of unity, otherwise it equals zero; or we may refer to X as "high" ($\geq$1.5 beds/1000) or $\tilde{X}$ as "low: ($<$1.5 beds/1000).

From 3.4 we see that the greatest secular decline in adjusted ALOS occurred in concurrent review hospitals located in areas having high numbers of extended care beds ($\overline{\Delta Y} = -0.88$). This results suggests that concurrent review activities in acute care institutions are more efficacious in regions having larger numbers of alternative (extended care) facilities. Significant secular decreases also occurred for concurrent review hospitals in low extended care bed areas ($\overline{\Delta Y} = -0.69$) as well as in the comparison hospitals also located in such areas ($\overline{\Delta Y} = -0.67$). The lowest secular decrease occurred in the comparison hospitals situated in areas having high extended care bed-population ratios. In such areas the difference in the secular change in adjusted ALOS between the comparison and the concurrent review hospitals [-0.30 - (-0.88) = +0.58 days] was considerably greater than was observed for the overall sample (which was approximately +0.20 days). This difference of about 0.6 days was highly statistically significant (P = 0.0002).

On the other hand, the difference in the secular change in adjusted ALOS for the comparison versus the study hospitals in areas having relatively small extended care bed ratios [-0.67 - (-0.69) = +0.02 days] was not at all significant (P = 0.87). The disparate results between the high and low extended care bed regions is reflected by a large [+0.58 - (+0.02) = +0.56 days] and statistically significant (P = 0.0003) value for the β_7 coefficient. This result reveals that there was a differential "PSRO effect" dependent on the regional extended care bed ratio.

As indicated in Tables 3.3 and 3.4, the β_7 coefficient can also be partitioned to reflect differences in $\overline{\Delta Y}$'s for concurrent review hospitals located

in high versus low bed ratio areas, and for comparison hospitals in high versus low bed areas. These results are inherently of less interest in this study, however, since the main focus of attention is the relative performance of comparison versus concurrent review hospitals, while holding constant a particular hospital characteristic. While the model is capable of yielding information on the relative performance of hospitals having different values of the characteristic variables within the concurrent review group or within the comparison group, that is not the principal focus of this study. Thus, in the sections discussing the estimation results for the various hospital characteristic variables, the major focus will be on the elements in the right-most column of the matrix given in Table 3.3; e.g., the right-most column in Table 3.4B [+0.58 - (+.02) = +0.56 days]. To repeat, it is this column that reveals whether the efficiacy of concurrent review activities was related to a particular hospital characteristic variable.

3.2.6 Trend Analysis

As an alternative to the pre-post analysis, which excluded a large fraction of the available information near the center of the sample period, a trend analysis was also performed. While similar in concept to the basic regression model, the trend model considered time to be a discrete, rather than a binary, variable. The revised model thus appears identical to the basic model; i.e.:

$$Y = \beta_0 + \beta_1 \text{ STYPE} + \beta_2 \text{ TIME} + \beta_3 \text{ S•T} + \varepsilon$$

where Y is either ALOS adjusted for ELOS, or ALOS-ELOS.

However, the variable TIME represents the quarter during which each observation was taken. Using the same reasoning as was given above, it is clear that

$$E[Y \mid STYPE = 0] = \beta_0 + \beta_2 \text{ TIME} = \text{trend line for concurrent review hospitals}$$

$$E[Y \mid STYPE = 1] = [\beta_0 + \beta_1) + (\beta_2 + \beta_3) \text{ TIME} = \text{trend line for comparison hospitals.}$$

As before, it is the regression parameter for the cross product term (β_3) that was the major focus of this study. That is, β_3 measured the difference in the secular rate of change in Y (adjusted ALOS) between the comparison hospitals and concurrent review hospitals. And, as before, the major null hypothesis was:

$$H_0 : \beta_3 = 0 \quad \text{versus} \quad H_1 : \beta_3 \neq 0.$$

If the PSRO concurrent review program had a significant impact on lowering average lengths of stay, then a positive β_3 would be observed.

3.2.7 Contingency Tables

In addition to the hypothesis tests performed with regression techniques, contingency table analyses were used to test the associations between various categorical variables. For example, if the variable is defined as:

$$\Delta Y = 1 \text{ if } [(ALOS\text{-}ELOS \mid POST) - (ALOS\text{-}ELOS \mid PRE)] \geq 0$$

and

$$\Delta Y = -1 \text{ if } [(ALOS\text{-}ELOS \mid POST) - (ALOS - ELOS \mid PRE)] < 0$$

then the following 2 x 2 contingency table can be constructed:

Direction of Change in ALOS→ / ↓Hospital Group	$\Delta Y = -1$	$\Delta Y = 1$	TOTAL
Concurrent Review Hospitals	n_{11}	n_{12}	$n_{1\cdot}$
Comparison Hospitals	n_{21}	n_{22}	$n_{2\cdot}$
TOTAL	$n_{\cdot 1}$	$n_{\cdot 2}$	N

Where $N = n_{1\cdot} + n_{2\cdot} = n_{\cdot 1} + n_{\cdot 2} = n_{11} + n_{12} + n_{21} + n_{22}$ is the total number of hospitals in the sample.

It can be shown that the expression

$$\chi^2 = \frac{N(n_{11}n_{22} - n_{12}n_{21})^2}{n_{1\cdot}n_{2\cdot}n_{\cdot 1}n_{\cdot 2}}$$

is distributed approximately as a chi-square with 1 degree of freedom. By comparison the observed value for χ^2 given by the expression above with the actual percentiles of a chi-square distribution, it was, therefore, possible to statistically test the null hypothesis

H_0: there is no association between concurrent review status and the sign of ΔY.

Or, equivalently, that the proportion of hospitals experiencing a decrease in adjusted ALOS between the pre and post periods was no different for the concurrent review hospitals as opposed to the comparison hospitals. Of course, it is possible to generalize the chi-square test by providing more categories for any two attributes. In such cases, the above 2 x 2 table becomes an n x m table where n and m are the number of categories for the two attributes whose association is to be tested. However, the n x m table poses interpretation problems not found in the 2 x 2 table analysis.

3.2.8 Measuring the Effects of Case Mix Changes

While the techniques presented above are capable of measuring a variety of effects related to the impact of PSRO concurrent review activities on hospital utilization rates, it is also of interest to consider an alternative technique that has been previously used for similar studies. It is possible to use index numbers similar to the Laspeyres Index (the basis for the Consumer Price Index) and the Paasche Index to study the effect on overall utilization of changes in case mix independent of case-specific changes in utilization, and conversely, the effect on overall utilization of changes in case-specific utilization rates independent of case mix differentials. For example, Rafferty[2] applied these tools in analyzing the changes in ALOS between the pre- and post-Medicare periods by defining:

$$I = \frac{\sum_i ALOS_i^0 f_i^1}{\sum_i ALOS_i^0 f_i^0} = \text{Case Mix Index (Laspeyres)}$$

and

$$I^1 = \frac{\sum_i ALOS_i^1 f_i^0}{\sum_i ALOS_i^0 f_i^0} = \text{Length of Stay Index (Reciprocal Paasche Index)}$$

where

$ALOS_i^0$ = Mean ALOS for the i-th diagnosis in the pre period

$ALOS_i^1$ = Mean ALOS for the i-th diagnosis in the post period

f_i^0 = Fraction (n_i^1/n) of patients in the i-th diagnosis group during the pre period

f_i^1 = Fraction (n_i^0/n) of patients in the i-th diagnosis group during the post period.

For example, if I = 1.05 we conclude that the overall ALOS would have been 5% higher in the post (vs. pre) period purely on the basis of changes in case mix between the two periods. Conversely, if I^1 = 0.95, the overall ALOS would have been 5% lower in the post period as a result of diagnosis-specific decreases in ALOS.

In Rafferty's study, comparisons of I and I^1 were made on the basis of patient age:

	I (Case Mix Effect)	I^1 (ALOS Effect)
Age $\geq$ 65	99.9	107.5
Age < 65	107.4	90.1

Thus, for older patients, the case mix remained constant between the pre- and post-Medicare periods. For younger patients, however, there was evidence of an increase in case mix severity which could have led to a 7.4% increase in ALOS if case-specific lengths of stay had remained constant. However, the value I^1 = 90.1 for younger patients indicates that case-specific lengths of stay did, in fact, decrease, thus showing that for the <65 group there was an increased case mix severity coupled with a case mix-adjusted decrease in ALOS. For the older patients, however, case mix remained constant while case mix-adjusted ALOS increased. The combined results strongly suggest that the enactment of Medicare benefits had the effect of re-allocating fixed medical resources from the young to the older patient groups.

When the index number technique was applied to the concurrent review versus the comparison hospitals using the Medicare data in this study, the following results were obtained:

	I (Case Mix Effect)	I^1 (ALOS Effect)
Concurrent Review	$\frac{10.8200}{10.7421}$=1.0026	$\frac{10.1886}{10.7921}$=0.9441
Comparison	$\frac{10.7448}{10.7240}$=1.0020	$\frac{10.3243}{10.7240}$=0.9627

Here the results are much easier to interpret: There was no case mix effect for either the concurrent review or the comparison hospitals, and there was a secular decrease in diagnosis-specific adjusted ALOS for both the study and the comparison hospitals; however, the decrease in adjusted ALOS was almost 2% greater in the concurrent review hospitals. Since the Medicare mean ALOS is in the order of 10 days, this last result indicates that the secular decrease from the pre to the post periods was about 0.2 days greater in the concurrent review hospitals for Medicare patients.

Using the same technique for the Medicaid sample yielded the following results:

	I (Case Mix Effect)	I^1 (ALOS Effect)
Concurrent Review	$\frac{6.1003}{6.0876}=1.0020$	$\frac{5.8538}{6.0876}=0.9616$
Comparison	$\frac{6.9482}{6.9550}=0.9990$	$\frac{6.3963}{6.9550}=0.9197$

As with the Medicare patients, there was virtually no change in the overall case mix severity; and, as before, there was a secular decrease in diagnosis-specific adjusted ALOS for both the comparison and the study hospitals; however, the decrease in adjusted ALOS was 4% greater in the comparison hospitals, a result opposite from that obtained for the Medicare sample. Again, using the Medicaid mean ALOS of about 6 days, we conclude that the secular decrease was about 0.2 days greater in the comparison hospitals versus the concurrent review for Medicaid patients. Again, this result is opposite from that obtained using the Medicaid patients; however, the more rigorous analysis techniques yielded results (to be discussed in succeeding sections) which are in very close agreement with these findings.

3.3 STAGING ANALYSIS

3.3.1 Issue

In any analysis of the impact of PSRO activities on length of stay, it is clearly desirable to deal with a patient population that is as homogeneous as possible. This was the rationale for stratifying patients by age, sex, diagnosis and similar medical/non-medical factors that are known or thought to affect LOS, independent of any specific programs designed to reduce it. It is known, for example, that an elderly patient hospitalized for pneumonia is likely to need a longer stay than a young person with a similar diagnosis because the elderly person's overall health status is likely to be more "fragile" in terms of recovery time, risk of complications, and other factors. Such normalizations are commonly done for studies such as this, and, indeed, are often part of PSRO LOS criteria.

In recent years, however, it has increasingly come to be recognized that these traditional stratification variables noted above are not sufficient, and that it would be highly desirable to include a measure of illness severity in the normalization process. It is clear that a patient who is "seriously" ill -- say, a burn patient with third-degree involvement over 60% of the body area -- will experience longer stays than a patient who is less seriously ill -- say, second-degree burns over 10% of body area. What is needed is a way of quantifying this concept of severity so that it can be used to normalize the patient mix.

In a sense, this could be considered an extension of the precedent of stratifying by major diagnosis; the severity measure would provide a more sophisticated way of taking explicit account of clinical characteristics in a patient population.

For the past four years, SysteMetrics, Inc. has worked on such a system for measuring clinical severity. It is called the "staging" methodology, and evolved from the clinical staging concept developed for measuring the severity of various forms of cancer. The staging system is now highly-developed, and has been used in a wide range of applications from quality assurance systems to outcome measurements to cost/severity studies. Part of this work included the development of computer programs that can classify patients by severity level for a wide range of diagnoses, using data from hospital discharge abstracts. Therefore, it was decided that as part of this project, a sample of patients from the data base would be staged to see if the staging severity index would give additional insight into the results of the primary statistical studies. In particular, we wanted to see if the case mix severity in the study and control hospitals had changed over time, and if the staging stratification changed any of the primary conclusions on the effectiveness of PSRO activities.

Because of time and cost considerations, the staging analysis was performed independently of the analyses described in the previous sections. This precluded the study of several very interesting issues related to severity. For example, we would like to have included a severity variable in the general regression model described above to see what percentage of the LOS variance was explained by differing severity levels within individual diagnostic categories. However, this was not possible because the general models used 23 diagnostic groups aggregated from the CPHA "List A" diagnostic groups, while the staging computations made use of the individual HICDA-2 codes at the individual patient abstract level. Theoretically, there is no reason why stage could not be included as a further refinement in an LSS-type of LOS in homogeneous diagnosis groups.

Nevertheless, it was felt that the staging analysis would be useful in and of itself, particularly in terms of casemix changes, and was, therefore, included in the study.

3.3.2 The Staging Concept

Staging is essentially a method of refining traditional diagnostic classifications so as to produce predictive clusters useful for evaluative studies. Historically, medical taxonomy has been based more on pathophysiological and anatomical findings than on the identification of patient groups which would be useful for predicting the results of medical treatment. Exceptions to this generalization have been in the area of cancer, where the staging concept has been developed as a technique for assessing the efficacy of various forms of treatment. For evaluative studies, however, it has become increasingly important to have available methods for identifying groups or clusters of patients that require common treatment procedures and services and have similar expected outcomes.

Staging involves defining different levels of severity for specific medical/surgical problems. The method calls for separating a medical problem into three stages: Stage I - A condition with no complications or problems of minimal severity; Stage II - A condition with local complications or problems of moderate severity; and Stage III - A condition with systemic complications or problems of maximal severity. Sublevels of these stages can also be defined, to allow more precise definition of the staging criteria. As an example, the stage definitions for appendicitis are shown in Table 3.5.

Table 3.5

Stage Definitions: APPENDICITIS

STAGE I: Appendicitis

STAGE II: A. Appendicitis with perforation leading to

localized peritonitis
or
abscess in peritoneum

B. Appendicitis with perforation leading to a subphrenic abscess

STAGE III: Problems listed in Stage II plus

diffuse peritonitis
or
septicemia (sign of infection in one or more organs)
or
shock (hypotension, oliguria, obtundation, signs of peripheral vascular collapse)
or
intestinal obstruction
or
pylephlebitis with or without liver abscess

Staging classifications have been developed for both medical and surgical problems, although for the latter the definitions are easier to develop, since the separation of a primary conditon (Stage I) from a primary condition with local complications (Stage II) is more readily apparent than in a medical problem. In addition, the system can also work for a medical problem with more than one etiology, such as diarrhea. Each staging definition has been translated into the equivalent HICDA-2 and ICDA-8 codes, and computer programs have been developed to classify patients by stage based on information in automated hospital discharge abstracts of the kind used for this study.

3.3.3 Approach

For this study all (Medicare and Medicaid) patients who fell into one or more of the diagnostic categories shown in Table 3.6 were assigned a stage classification.

TABLE 3.6

Diagnoses Used for Staging Analysis

HICDA-2 Primary	Description	Stage I Appropriateness
9	Diarrhea (gastroenterites)	N
153	Colon Carcinoma	Y
174	Carcinoma of the breast	Y
180	Carcinoma of the cervix	Y
185	Carcinoma of the prostate	Y
250	Diabetus Mellitus	N
302	Alcoholism	N
401	Hypertension	N
410	Myocardial infarction	Y
451	Thrombophlebitis (peripheral)	Y
481	Bacterial pneumonia	Y
531	Peptic ulcer disease	N
540	Appendicitis	Y
550	External hernia	N
562	Divecticulitis	Y
563	Ulcerated colitis	Y
571	Cirrhosis of the liver	Y
575	Cholecystitis	Y
577	Pancreatistis	Y
590	Urinary tract infection	N
592	Kidney renal calculus disease	Y
600	Benign prostatic hypertrophy	N
712	Rheumatoid arthritis	N

This list was chosen to effect a high capture rate and because it contains conditions that account for a large number of days of care. The last column of this table requires some explanation:

> The column labeled "Stage I Appropriateness" shows whether common medical practice indicates hospitalization at Stage I (Y), or whether a Stage I condition does not necessarily require hospitalization (N). This is of interest because one effect of PSRO activity should be to restrict inappropriate admissions, and thus we would expect to find a relatively greater reduction in Stage I admissions for the "N" diagnoses in the study hospitals.

All patient records in the data base were run against the staging criteria for these conditions and the patients whose primary discharge diagnosis fell into one of the selected diseases were captured and staged. This resulted in a total staged sample of 104,870 patients, 27% of the population. Of these, 20,992 were Medicaid and 83,878 were Medicare. This distribution reflects the fact that the conditions chosen excluded childbirth and complications thereof, and also contained some diseases more commonly found in older patients (prostate cancer, BPH, etc.).

3.3.4 Statistical Tests

The staged data were analyzed in two ways:

- Changes in ALOS were examined for each diagnosis and each stage within each diagnosis. Comparisons were made between study and control hospitals in the pre vs. post time periods. The purpose of this analysis was to provide greater insight than was possible in the primary analysis into the impact of disease severity on changes in ALOS.

- Staging "profiles" -- the relative mixtures of various levels of illness over time -- were examined to see if there had been any significant change in the severity casemix of the pre and post population, and if these changes were more or less pronounced for the PSRO hospitals. The hypothesis here was that PSRO activity might discourage the admission of patients who were not seriously ill, and thus would shift the casemix in favor of greater severity of illness. To the extent that this was medically defensible, it would indicate a positive

PSRO effect, even if ALOS did not decline (as it might not, if hospitalized patients were more seriously ill).

The first issue was addressed in the same manner as was ALOS adjusted for ELOS in Sections 3.2.1 and 3.2.2. Again the basic multiple regression model was used:

$$LOS = \beta_0 + \beta_1 \text{ STYPE} + \beta_2 \text{ TIME} + \beta_3 \text{ S•T} + \varepsilon.$$

For the staging analysis, however, individual patients were the unit of observation, hence the OLS technique was appropriate and the GLS method was not required. Further, since a separate regression was performed for each stage of disease, the ELOS variable was not included as a measure of disease severity.

As before it is easy to show that

$$\beta_{01} = \mu_{00}$$

$$\beta_1 = \mu_{10} - \mu_{00}$$

$$\beta_2 = \mu_{01} - \mu_{00}$$

$$\beta_3 = (\mu_{11} - \mu_{10}) - (\mu_{01} - \mu_{00}).$$

Thus the meanings of the coefficients are:

β_0 = mean LOS in the study hospitals in the pre period

β_1 = difference in the mean LOS between control and study hospitals in the pre period ($\beta_1 > 0 \Rightarrow$ CR hospitals had lower initial ALOS

β_2 = change in the mean LOS for the study hospitals, post-pre ($\beta_2 < 0 \Rightarrow$ ALOS declined in the CR hospitals)

β_3 = difference in the ALOS change between control and study hospitals, post-pre ($\beta_3 > 0 \Rightarrow$ CR hospitals experienced a greater ALOS reduction or a lesser ALOS increase than did the comparison hospitals).

Thus, the regression coefficients can be tested for significance for their respective hypotheses. In particular, the coefficient β_3 tells us, for a given diagnosis and stage, whether the controls or the study hospitals were more effective in reducing (or minimizing the increase of) ALOS.

CHAPTER 3 FOOTNOTES

1. U.S. DHEW, Office of the Assistant Secretary for Health, Office of Professional Standards Review, Program Evaluation Plan: Professional Standards Review Organizations, September 22, 1975.

2. Rafferty, John, Net Prices and Non-Price Rationing: An Analysis of the Effects of Insurance on Hospital Output Mix, NCHSRD, April 1972.

4. DATA SOURCES, QUALITY, VALIDITY

The data base used in the analysis of the effects of the PSRO program concurrent review activity on hospital utilization was developed by General Research Corporation and SysteMetrics under contract to HSA/OPEL. In order to include in the data base the data elements required for the analysis it was necessary to obtain data from individual Medicare, Medicaid and Title V patient discharge abstracts for a sample of hospitals that were performing PSRO concurrent review and for a comparison sample of hospitals that were either not performing review or performing utilization review not under the auspices of a PSRO. In addition, these data had to be merged with hospital and area-related (county) information in order to answer effectively the intended analytical questions.

4.1 ABSTRACT SOURCES

The only feasible sources for large-scale data of the type required by this analysis were hospital abstract services. There are currently several organizations that offer abstract/data services to which individual hospitals may subscribe. However, because of the limited coverage and/or decentralized structure of most of the abstract services, it was decided to seek data from only the two services listed below.

1. Commission on Professional and Hospital Activities. CPHA operates the PAS system and ancillary services (MAP, CRIS, etc.). It is by far the largest service.

2. California Health Data Corporation. CHDC operates the MR II system. It is widely used in California and other western states.

In order to meet the intended analytical requirements, the files produced had to contain data elements that described:

(1) Hospital utilization (length of stay-LOS), diagnosis, age, sex, and source of payment (Title V, XVIII, or XIX);

(2) Hospital characteristics likely to be related to LOS, such as teaching status or occupancy rates;

(3) Characteristics of the PSRO review process such as review start dates or hospital delegation status; and

(4) Area characteristics likely to be associated with LOS such as extended care beds or physicians available per 1000 population.

The data elements initially specified by DHEW as necessary for the analyses were included in final data files with the exception of a number of admission-specific PSRO-related elements that were simply not available from: (1) The abstract services because they were not included in the data files at all until the final quarter of interest in this study and, even then, were available for less than one-fifth of concurrent review hospitals or (2) The Bureau of Quality Assurance because the information in their files contained only disguised hospital identifiers. Patient residence (zip) codes were also deleted from the final data file because they were available only on a very limited basis and because their inclusion would pinpoint specific hospitals.

The final patient abstract file included all dishcarge abstract data grouped by hospital, and patient discharge date, indicating whether or not the subject hospital was performing PSRO concurrent review and the date review began. A list of the data elements and the file structure for the patient abstract data set appear in Appendix A.

4.1.1 Quality and Validity of Abstract Data

As has already been stated, some of the analysis reported here deals with specific diagnosis groupings. The reliability of primary diagnosis assignment on patient discharge abstracts has been examined in several studies. The best known such study was recently conducted by the Institute of Medicine.[2] Because the diagnosis groups examined in the Institute of Medicine study do

do not match well with the diagnosis groups examined here, no quantifiable measures of reliability can be assigned to the diagnosis specific data analyzed here. However, it should be noted that a certain amount of change over time for both diagnosis group specific average length of stay and for distribution of patients by diagnosis groups should be expected simply as a function of either erroneous assignment of primary diagnosis or the uncertainty of assignment for patients who are particularly difficult to label. The amount of secular change expected here due to the reliability issue is unknown.

The Institute of Medicine's study does provide a perspective on the relative reliability of assignment for certain diagnosis groupings. For example, of the diagnoses studied, the diagnosis groups recorded with least reliability in the Institute of Medicine's study were: cerebrovascular disease, chronic ischemic heart disease, and acute myocardial infarction. When results of this evaluation deal with these three diagnosis groups, it would be desirable to keep in mind their relative lack of reliability.

4.2 HOSPITAL SOURCES

Hospital variables were generally taken from the 1974 Master Facilities Inventory (MFI) file provided by the Health Resources Administration DHEW based on data collected in the American Hospital Association annual survey of hospitals. Teaching status, however, came from the 1973 MFI. The groups into which the variables were categorized were selected based upon DHEW interest in the category, standard usage (i.e., NCHS, Census, etc.) and requirements for confidentiality -- in each case the smallest number of categories consistent with analytical utility was adopted.

PSRO-related hospital variables (such as binding review date and delegation status) were provided by DHEW and originated with either the Bureau of Quality

Assurance (BQA) or the Social Security Administration (SSA). In interpreting the results of this analysis we caution the reader that these PSRO binding review dates do not necessarily signify that review was not in place prior to that time, but simply that review under PSRO auspices was not approved prior to that date. In particular, some hospitals (although not necessarily included in the sample) are known to have implemented hospital sponsored concurrent review quite early, in some cases in response to the since withdrawn U.R. Regulation of 1974. All hospitals in the study are believed to be in substantial compliance with the relevant Medicare and Medicaid conditions of participation with regard to U.R. A list of the data elements and the layout for the hospital file appear in Appendix B.

4.3 AREA SOURCES

Variables indicating the characteristics of the PSRO area (such as short-term beds per thousand population) were derived from the American Hospital Association's Area Resource File (ARF). This data source provided statistics on a county-by-county basis. Groupings of these data were empirically determined based upon the distribution of sample hospitals. Groups were selected that would provide a reasonable range of variability on the parameter of interest with the fewest number of categories possible. The ranges for these grouped county variables are shown in the hospital file layout in Appendix B.

4.4 SAMPLING PLAN

There were several reasons for employing proper statistical design concepts in the process of the PSRO data base development. The basic purposes were to assure that the estimates of interest would have meaningful precision and that it would be possible to estimate that level of precision. The design had to

be specified to afford a good chance of making conclusive tests of hypotheses that were of interest. And the design had to be efficient, i.e., provide a good return of precision for the sampling effort expended.

Development of an efficient survey design was achieved by taking into account the precision requirements of the study, the characteristics of the survey population, and the costs of sampling. The process of developing an acceptable sample design involved consideration of the following factors:

- Study objectives;
- Study variables;
- Target population and sample frame;
- Nature of the analytical model to be employed;
- The role of comparison groups; and
- Design structure (sampling units, strata, clusters, stages, sample size, sample allocation, and sample selection methods).

Each of these factors is discussed in the section that follows.

4.4.1 Study Objectives

The main purpose of the sampling plan was to develop a data base that would permit subsequent estimation of the impact of PSRO concurrent review on length of stay. The nature of the sample design was affected by the specification of the estimates for which it was desired to have maximum precision. The choice was between having high precision for overall-population estimates (for estimates of specified subgroups of the population), or for estimates of specified parameters. It appeared that in the present study, emphasis should be placed on the estimation of structural relationships for the following reasons:

- The existing population of hospitals performing PSRO concurrent review and the complementary population of comparison hospitals were empirically defined, non-randomly selected populations, and not conceptually meaningful populations in their own right.

- Because of the influence of many variables on LOS, it would be necessary to take into account their simultaneous impact on LOS. These factors were accounted for by calculating, for each patient, expected length of stay (ELOS) using CPHA's LSS Program.

4.4.2 Study Variables

There were two kinds of variables that were of interest in the current study: dependent variables, such as LOS, and independent or explanatory variables, such as bed size, occupancy rate, type of control (ownership status), location (urban/rural) or hospital type (teaching/non-teaching). The latter variables were of interest for two reasons. First, they were thought to be potentially useful as variables of stratification to improve design efficiency; and second, they were thought to be potentially useful as concommitant variables in a parametric model describing the association of LOS with concurrent review introduction.

4.4.3 Target Population and Sample Frame

Ideally, the population of interest in the current study would have been abstracts from all short-term, non-federal hospitals in the United States. However, not all such hospitals subscribe to abstracting services, and the hospital population of interest was of necessity reduced to those that did subscribe. Specifically, as indicated in Section 4.1, the target population was restricted to those hospitals served by the CPHA/PAS and CHDC abstracting services.

The population of short-stay, non-federal abstracting hospitals represented the primary sample units. The second stage units, associated with each hospital, were the abstracted records. In order to measure the change introduced by concurrent review, it was necessary to analyze records from before and after the point in time at which concurrent review was initiated. Records from

January, 1974 through September, 1976 were included in the population of interest. A somewhat longer period of time (e.g., at least five years) would have been preferable, but this was not possible within the time constraints of the data base development. Such a restriction would have unduly limited the hospitals available for the study.

The sample frame for the study was all short-stay, non-federal hospitals served by the two abstract services continuously since January 1, 1974, that were listed on the 1974 Master Facility Inventory (MFI). Statistical analyses were conducted on the 1974 MFI to determine the characteristics of the hospital population, by variables such as size, location, etc.

One of the first questions addressed in the data base development was the nature of the hospitals served by the abstracting services mentioned above. Analyses showed that the population of hospitals on abstracting services (N = 1416) differed somewhat from the population of all hospitals (N = 6272) with respect to bedsize characteristics, occupancy rate, and ownership. The population of abstracted hospitals was more similar, however, with respect to Census region, teaching status, and urban/rural status. A detailed comparison of the universe of hospitals with the sample frame hospitals is included in Section 4.5, where we also discuss the composition of the participating hospital samples.

4.4.4 Nature of the Analytical Model to be Employed

For this analysis, it was decided that the design should emphasize the traditional regression model, rather than a time series model. This decision implied that the population should be stratified with respect to variables that were considered to have a potentially substantial impact on LOS, and the sample allocated over these strata in a relatively "balanced" fashion, to assure

high variability of the sample with respect to the key variables.

An issue that needed to be resolved in the analysis was how allowances should be made for the fact that the abstracted and concurrent review hospital populations were not representative of the total hospital population. The differences between the abstracted concurrent review hospital population and the the total hospital population were great enough so that the unbiased sample estimates could not be represented as reasonable estimates of the total hospital population. In order for the analysis results to be useful for decision makers, however, it would appear difficult to avoid making estimates of the concurrent review impact, both for the total hospital population and various subpopulations. This means expanding various stratum estimates, or estimating the relationship of CR impact to various explanatory factors. In order to maximize the precision of these estimates, it was desirable that the sample "weights" (reciprocals of the probability of selection) not vary tremendously. However, hospitals in the Census western region and in SMSA's were substantially overrepresented which, in turn, appeared to lead to an overrepresentation of teaching hospitals. The over- and under-representation would lead to disparate weights and in turn to lessened precision for the sample estimates. This suggested, therefore, that the abstracted hospital population be stratified by Census region and urban/rural status, and that the number of abstracted hospitals that were selected from each stratum be approximately proportional to the total number of hospitals in each stratum (rather than proportional to the number of abstracted hospitals in each stratum). This objective is moot for the abstracted concurrent review hospitals, since all of this population (N = 136) had to be sampled to obtain the desired sample size.

It was recognized that the above procedure would lessen the precision of the estimates that refer to the abstracted populations. It would increase the

precision, however, of the (biased) expansion or relationship estimates of the total hospital population. Since the proportion of abstracted hospitals in each region/SMSA stratum was not drastically different from the proportion of total hospitals, the precision losses and gains involved were not expected to be very large.

4.4.5 The Role of Comparison Groups

It was important to include non-concurrent review hospitals in the analysis. Their inclusion in the design was necessary to guard against concluding that a LOS change was due to PSRO concurrent review and not to some other (unknown) factor. For example, all hospitals -- both concurrent review and non concurrent review -- may have experienced some LOS change. If only CR hospitals were studied, we might incorrectly conclude that concurrent review had "caused" the LOS change.

In a regression-type model, the inclusion of a comparison group reduces the chance of concluding that a LOS change is associated with concurrent review, when in fact non-concurrent review hospitals may have experienced a similar change. The role of the comparison group diminishes in importance as the complexity of the model increases.

A major issue that had to be addressed in the selection of comparison hospitals was whether to select a sample that was matched closely to the set of PSRO concurrent review hospitals. While the selection of matched comparison samples had been adopted in many evaluation studies, it has associated with it a serious methodological problem -- the so-called "regression effect" or "regression to the mean." Under the matching concept a set of comparison hospitals is selected that is very similar to the experimental hospitals, based on a number of variables. It is then argued that whatever differences are observed between the experimental and comparison hospitals should be due to the

"treatment" difference (i.e., concurrent review impact). However, since the comparison group was not determined through random selection, any observed difference could be due to some variable that was overlooked in the matching process. Furthermore, because of the possibility of "regression to the mean", it is possible that the observed mean for the controls would be a biased estimate of the true mean, rendering impossible a valid comparison between experimental and comparison hospitals.

Because of these problems, the matching technique was not adopted. As a consequence, absolute differences in mean LOS between the experimental and comparison populations were adjusted in the analysis by introducing into the model case severity variables, i.e., CPHA's Expected LOS and SysteMetrics' Disease Staging (severity of illness) Index.

4.4.6 Design Structure

As discussed above, the structure of the PSRO data base design had to be such that adequate variation occurred over those variables considered to have a potentially significant association with the relationship of CR to LOS. At the outset of the data development work, six variables were identified as being of potential significance and the following decisions were made regarding stratification:

* Geographic Region. Geographic region was known to be correlated with LOS, and since CR can potentially achieve greater impact in high LOS areas like the Northeast, the LOS improvement associated with CR would likely vary by region. It was considered, however, that the regional differences in LOS probably reflect the causal impact of other variables (such as bed availability, occupancy rate, etc.). Since the regions do vary somewhat in size, the sample weights would vary rather considerably if equal allocations of sample units were made to each region. Finally, if a proportional allocation were used, all regions would be represented rather well (i.e., none are extremely small). For these reasons, it was decided to use a proportional allocation of sample units over the regions.

* Short-Term Bed Size. Because of a desire to be able to compare the results of this study to previous studies which present results by bed size, it was decided to stratify the present target population by bed size and allocate an equal portion of the sample to the various categories.

* Teaching Status. Since it was believed that CR may have a greater impact in non-teaching hospitals, it was decided to allocate more of the sample to this category, to enhance the likelihood of detecting a significant impact (given the small overall sample size). Since a proportional allocation over the two teaching status categories would emphasize the non-teaching hospitals without producing disparate sample wights, this allocation was selected for teaching status.

* Short-Term Occupancy Rate. It was considered that the low occupancy rate hospitals might offer more room for LOS improvement than high occupancy rate hospitals. Since the proportion of low occupancy rate hospitals is low, however, the normally-preferred proportional allocations would have resulted in very few low-occupancy rate hospitals appearing in the sample. For this reason, an equal allocation of the sample to the various occupancy rate categories was chosen.

* Urban-Rural Status. Urban-rural status is rather highly correlated with occupancy rate and bed size, which, as indicated above, was to be stratified with equal allocations. Also, the association of LOS to this variable was considered to be reflective of other "casual" variables, rather than a cause in its own right. For these reasons, it was decided not to stratify on urban-rural status.

* Ownership-Control Type. Ownership type, whether government or private, profit or non-profit, is highly correlated with occupancy rate, which was selected for balanced stratification. Furthermore, the ownership categories vary substantially in size, so that an equal allocation would have produced quite disparate sample weights, with concommitant loss in overall precision. For these reasons, it was decided not to stratify on ownership type.

To summarize then, the sample allocation was decided to be as follows:

1. Geographic region: proportional allocation
2. Short-term bed size: equal allocation
3. Teaching status: proportional allocation
4. Occupancy rate: equal allocation
5. Urban-rural status: not used
6. Ownership control: not used

A problem that arose immediately was that the number of stratum cells in this cross-stratification was very large compared to the sample size. For this reason, a "controlled selection" approach to sampling was adopted. Under this procedure, a number of "patterns" of stratum cells was developed, each representing a desirable range of variation over the variables of stratification. Each such pattern was then given a probability of selection such that more "desirable" patterns had higher probabilities of selection, and the expected stratum sample sizes that would result from the pattern selection were as desired (i.e., either equal or proportional). Every stratum cell containing any sample units was represented in some pattern, so that every population element had a non-zero probability of selection. It was decided that the usual method (proportional allocation) of stratification would be used for the region and teaching status categories but that controlled selection would be used for the bed size and occupancy rate categories (equal allocation).

Because of the small number of study hospitals, it was decided to include all of the 136 CR hospitals (i.e., those on abstracting services by 1/1/74 and doing CR starting between 9/16/74 and 1/1/76) in the sample, and to select a sample of 94 comparison hospitals using the above methods. The stratified, controlled selection procedure was therefore applied only to the comparison hospitals.

The primary sampling units (clusters) of the design were CR and comparison hospitals themselves. The second stage sampling units were all federally financed discharge abstracts in each selected hospital. All federally financed discharge abstracts were included for the periods under study to maximize diagnosis-specific data for each month of observation.

Table 4.1 presents a breakdown of the universe of all 6,272 short-term hospitals, according to the four variables of stratifiaction (or controlled selection): region, bed size, teaching status, and occupancy rate. Table 4.2 shows the percentages of hospitals in the teaching status region stratification--two stratification variables for which proportional allocations were used. Table 4.2 also shows what portion of the 94 comparison hospitals were included in each cell.

4.4.7 Case Study Comparison Groups

In addition to the overall analytical strategy and sampling design described above, attention was also given to the fact that the PSRO program has been actively and fully implemented in some PSRO areas, while being totally inactive in other areas. Because of this characteristic of the program's historical development, it was decided that another level of analysis, based upon the PSRO area as the analytical unit, should also be considered. This case study approach, like the overall strategy, required the inclusion of comparison groups to deal with competing "secular trend" hypotheses or hypotheses based upon the unique characteristics of a state or locality.

As indicated, all abstracting CR hospitals were included in the samples. We therefore examined the distribution of these hospitals by PSRO area and looked for adjacent but inactive PSRO areas in which a relatively large proportion of hospitals were participating in one of the selected abstracting services. In the end, four active PSRO areas were matched with six inactive PSRO areas. No attempt, however, was made to match hospitals across PSRO areas.

Table 4.1 DISTRIBUTION OF UNIVERSE OF 6,272 HOSPITALS OVER STRATA CELLS

Bedsize:	TEACHING						NON-TEACHING						
Occupancy Rate →	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	
6-49	0	0	0	0	0	0	42	25	20	16	9	7	
50-00	0	1	4	3	3	0	12	24	57	52	30	2	
100-199	2	2	6	8	14	3	2	10	47	96	52	14	
200-299	0	2	3	11	34	12	2	1	13	46	40	12	
300-400	0	1	5	39	71	19	0	1	3	7	20	4	
500+	0	0	1	21	39	9	0	0	0	2	3	0	
	313						681						994

Region I - Northeast

Bedsize:	TEACHING						NON-TEACHING						
Occupancy Rate →	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	
6-49	0	0	0	0	0	0	234	152	102	57	22	5	
50-00	1	0	1	2	1	0	58	81	173	78	34	5	
100-199	1	1	7	12	16	3	17	32	98	101	49	9	
200-299	1	0	7	19	22	4	1	9	21	59	32	5	
300-400	0	1	4	32	55	12	0	1	10	36	33	4	
500+	1	1	7	24	37	15	0	0	0	5	4	0	
	287						1,527						1,814

Region II - North Central

Table 4.1 Continued

Bedsize:	TEACHING						NON-TEACHING						
Occupancy Rate →	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	
6-49	0	0	1	0	1	0	190	235	167	92	41	18	
50-00	4	0	1	3	1	1	97	110	210	128	70	22	
100-199	3	1	10	12	4	0	34	42	108	151	90	14	
200-299	0	1	7	15	8	4	2	5	21	59	44	3	
300-400	1	1	2	29	46	2	1	1	7	38	29	6	
500+	0	2	0	26	32	4	0	0	0	4	8	0	
	222						2,047						2,269

Region III - South

Bedsize:	TEACHING						NON-TEACHING						
Occupancy Rate →	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	
6-49	1	1	1	0	0	0	243	97	65	21	10	4	
50-00	1	1	2	0	0	0	86	63	107	34	8	0	
100-199	2	4	14	7	0	0	28	37	79	48	20	2	
200-299	2	1	5	13	7	1	8	6	17	35	14	1	
300-400	0	1	9	23	12	0	0	3	6	19	5	0	
500+	0	0	4	10	5	0	0	0	1	0	0	1	
	127						1,068						1,195

Region IV - West

6,272

Table 4.2 PROPORTIONAL ALLOCATION OF 94 COMPARISON HOSPITALS TO TEACHING STATUS AND REGION STRATUM CELLS

		TEACHING STATUS		
		TEACHING	NON-TEACHING	TOTAL
REGION	I (Northeast)	.050 (5)	.109 (10)	15
	II (North Central)	.046 (4)	.243 (23)	27
	III (South)	.035 (3)	.326 (31)	34
	IV (West)	.020 (2)	.170 (16)	18
TOTAL		14	80	94

4.4.8 Sample Selection

Table 4.3 describes in graphic form the process by which the sample of comparison hospitals was selected. The following paragraphs describe the data entries in this table.

The first step in selecting the comparison hospitals was to restrict sampling to a previously-drawn simple random sample[1] of 1,000 hospitals, selected from the universe of 6,272 hospitals. The reason for this restriction was to provide comparability of the results of the present study with the results of the other study. Since the previous sample was a simple random sample, no biases are introduced. However, some flexibility for stratification and controlled selection was probably lost by this two-stage sampling procedure.

[1] The number of abstracted non-CR hospitals in the sample of 1000 was 264. This is the number of hospitals on which Table 4.3 is based. We shall refer to these 264 hospitals as the "comparison universe".

Each cell of Table 4.3 contains a series of numbers. These numbers are as follows:

U, S, I_1, I_2
P_1, P_2, P_3, P_4

U = Number of hospitals of the comparison universe that are in this cell;

S = Number of sample hospitals to be selected from this cell;

I_1, I_2 = Index numbers of the sample hospitals to be selected from this cell (i.e., select the I_1th and, if present, the I_2th hospital in that cell)

P_1, P_2, P_3, P_4 = Patterns of which this cell is a member.

The number of patterns specified for each section of the cross-stratified design were as follows:

Region I, Teaching = 5 Patterns (No. 2 selected)

Region I, Non-Teaching = 2 Patterns (No. 1 selected)

Region II, Teaching = 4 Patterns (No. 4 selected)

Region II, Non-Teaching = No Patterns

Region III = No Patterns

Region IV, Teaching = 5 Patterns (No. 1 selected)

Region IV, Non-Teaching = No Patterns

Within each section of the design, all patterns were assigned equal probabilities of being selected. For example, each of the five patterns of the "Region I, Teaching" section was assigned a .2 chance of selection.

Random numbers were selected corresponding to patterns numbered 2, 1, 4, and 1 for the various sections of the design. (These pattern numbers are circled in Table 4.3). With this information, the values of the sample sizes (S) were determined for each cell.

The number of hospitals in the occupancy rate and size categories turned out to be only approximately equal. These numbers were not exactly equal (as desired) for two reasons: (1) there were not sufficient hospitals to permit equal numbers, or (2) the controlled selection procedure was based on an expected sample number in each stratum, not an exact number, as in stratification.

The selection of hospitals from each cell was done using simple random sampling with replacement. As it turned out, either one hospital or all hospitals were sampled for each cell, except for one cell in which two out of three hospitals are the "I_i's" of each cell. (The "I_i's" are omitted from a cell if all hospitals in the cell were selected.) The data file containing the entire "comparison universe" of 264 hospitals was sorted by bed size within occupancy rate, within teaching status, within region to produce a list of hospitals corresponding to the columns of Table 4.3. This list was then systematically scanned to select the I_ith hospitals in each section of the list corresponding to a cell in Table 4.3. This completed the sample selection process.

Table 4.3 SAMPLE DESIGN SPECIFICATION

		TEACHING						NON-TEACHING						
Occupancy Rate →		.001-.499	.500-.599	.600-.699	.700 .799	.800-.899	.900+	.001-.499	.500-.599	.600-.699	.700 .799	.800-.899	.900+	Sample Sizes
Bedsize	6-49	0	0	0	0	0	0	0	0	0	0	0	0	0
	50-99	0	0	0	0	0	0	0	0	0	0	1,1 ①,2	0	1
	100-199	0	0	1,1 1,②,4,5	0	1,0 4	1,0 3	0	1,1 ①,2	2,1,1 ①,2	4,1,1 ①,2	1,0 2	0	4
	200-299	0	0	②,3,4,5	0	3,0 5	1,0 1	0	0	1,1 ①	2,1,2 ①,2	3,0 2	2,1,2 ①,2	4
	300-499	0	0	1,0 1,3,5	4,1,2 ②,4	10,0 1,3	2,1,2 ②,5	0	0	1,1 ①,2	0	3,1,1 ①	0	4
	500+	0	0	0	3,0 1,3,5	9,1,4 ②	4,0 4	0	0	0	0	1,1 1,2	0	2
	Sample Sizes	0	0	2	1	1	1	0	1	3	2	3	1	15

Region I - Northeast

		TEACHING						NON-TEACHING						
Occupancy Rate →		.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	.001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	Sample Sizes
Bedsize	6-49	0	0	0	0	0	0	1,1	1,1	1,1	1,1	0	0	4
	50-99	0	0	0	0	0	0	0	3,2,2,3	3,1,1	3,1,3	2,1,1	0	5
	100-199	0	0	1,1 1,2,3④	0	2,0 3	0	0	2,1,2	4,1,1	3,1,1	1,1	1,1	6
	200-299	0	0	0	2,0 1,2	5,1,1 ④	0	0	0	2,2	11,1,1	2,1,2	0	5
	300-499	0	0	0	6,1,2 ④	12,0 1	2,0 2,3	0	0	0	7,1,1	5,1,3	1,1	4
	500+	0	0	0	3,0 3	12,0 2	2,1,2 1,④	0	0	0	3,1,3	1,1	0	3
	Sample Sizes	0	0	1	1	1	1	1	4	5	6	5	2	27

Region II - North Central

Table 4.3 Continued

Bedsize	Occupancy Rate →	TEACHING .001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	NON-TEACHING .001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	Sample Sizes
	6-49	0	0	0	0	0	0	0	1,1	0	1,1	0	0	2
	50-99	0	0	0	0	0	0	1,1	1,1	2,2	0	1,1	0	5
	100-199	0	0	0	0	0	0	0	0	1,1	2,2	3,3	0	6
	200-299	0	0	0	0	0	0	0	0	0	4,4	3,3	1,1	8
	300-499	0	0	0	2,1,1	7,1,5	0	0	0	0	6,6	2,2	0	10
	500+	0	0	0	4,1,3	11,1,9	0	0	0	0	0	1,1	0	3
	Sample Sizes	0	0	0	2	2	0	1	2	3	13	10	1	34

Region III - South

Bedsize	Occupancy Rate →	TEACHING .001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	NON-TEACHING .001-.499	.500-.599	.600-.699	.700-.799	.800-.899	.900+	Sample Sizes
	6-49	0	0	0	0	0	0	4,1,2,4	0	2,1,2	0	0	0	3
	50-99	0	0	0	0	0	0	0	1,1	1,1	0	0	0	2
	100-199	1,1 (1)4	0	0	1,0 3	0	0	0	3,1,1	6,1,5	4,1,4	2,1,1	0	5
	200-299	0	1,0 2,5	0	3,0 4	0	0	0	0	1,1	1,1	1,1	0	3
	300-499	0	0	1,0 3	2,0 5	0	0	0	1,1	0	2,2	0	0	3
	500+	0	0	0	1,0 2	1,1 (1)	0	0	0	0	0	0	1,1	2
	Sample Sizes	1 1	0	0	0	1	0	2	3	4	4	2	1	18

Region IV - West

4.5 REPRESENTATIVENESS

4.5.1 Concurrent Review Hospitals

The total number of hospitals commencing performance of concurrent review (and on a participating abstract service) during the criterion periods was sufficiently small (N=136) that, in order to obtain the required sample, it was necessary to include the entire set of hospitals in the final sample. Table 4.4 illustrates the relationship between

Table 4.4

Distribution of all Hospitals: All Concurrent Review Hospitals, and Sample Concurrent Review Hospitals on Selected Hospital-Related Variables

Variable	Category	All Short-Term Hospitals (N=6272)		CONCURRENT REVIEW: All Hospitals Beginning CR Between 9/16/74 and 1/1/76 (N=468)		CONCURRENT REVIEW: All Hospitals Beginning CR Between 9/16/74 and 1/1/76 and on Abstract Service Since 1/1/74 (N=136)	
Bedsize	6- 49	1879	(30%)	132	(28%)	12	(9%)
	50- 99	1571	(25%)	97	(21%)	23	(17%)
	100-199	1312	(21%)	92	(20%)	33	(24%)
	200-299	645	(10%)	62	(13%)	33	(24%)
	300-499	599	(10%)	59	(13%)	23	(17%)
	500+	266	(4%)	26	(6%)	12	(9%)
Occupancy Rate	0-64.9%	2701	(43%)	201	(43%)	37	(27%)
	65-69.9%	766	(12%)	61	(13%)	22	(16%)
	70-74.9%	722	(12%)	61	(13%)	21	(15%)
	75-79.9%	771	(12%)	53	(11%)	21	(15%)
	80%+	1312	(21%)	92	(20%)	35	(26%)
Ownership	Govt., Non-Fed.	1921	(31%)	133	(28%)	26	(19%)
	Non-Govt., Non-Profit	3467	(55%)	291	(62%)	98	(72%)
	Non-Govt., For Profit	884	(14%)	44	(9%)	12	(9%)
Census Region	Northeast	994	(16%)	52	(11%)	10	(7%)
	North Central	1814	(29%)	72	(15%)	47	(36%)
	South	2269	(36%)	118	(25%)	24	(18%)
	West	1195	(19%)	226	(48%)	55	(40%)
SMSA	Rural (Non-SMSA)	3131	(50%)	241	(51%)	34	(25%)
	Urban (SMSA)	3141	(50%)	227	(49%)	102	(75%)
Teaching Status	Residency	949	(15%)	94	(20%)	41	(30%)
	Non-Residency	5323	(85%)	374	(80%)	95	(70%)

(1) the universe of all short-term, non-federal hospitals, (2) the universe of concurrent review (CR) criterion hospitals, and (3) the concurrent review sample (and sample frame) hospitals selected for this study.

Comparisons of the total hospital universe (N=6272) and the universe of CR hospitals (N=468) indicate a substantial degree of distributional similarity between the two groups on the variables examined with the sole exception of regional distribution. Far West hospitals are substantially over-represented in the CR universe, while hospitals from all other regions are under-represented. Since average LOS is lower in the West than in other regions, it is unlikely that studies of these early CR hospitals will demonstrate as much impact with the introduction as will be the case when all hospitals are subject to CR.

The sample of CR hospitals that participated in abstract services (N = 136) and exhibits distributional patterns that deviate not only from all the hospital universe, but even from the early CR hospital universe. These deviations may be summarized as follows:

- Small hospitals are under-represented, while large hospitals are over-represented;
- Low occupancy rate hospitals are under-represented, while high occupancy rate hospitals are over-represented;
- Private, non-profit hospitals are over-represented, while non-federal public hospitals are under-represented;
- Western and Midwestern hospitals are over-represented, while Southern and Eastern hospitals are under-represented;

- Urban hospitals are over-represented, while rural hospitals are under-represented; and
- Teaching hospitals are over-represented, while non-teaching hospitals are under-represented.

While this picture is somewhat discouraging from the perspective of making parameter estimates that are applicable even to the universe of early CR hospitals, there is a sufficient distribution on all of the variables in question to permit reasonable estimates of relationships -- a major analytical goal. Moreover, as will be seen in the next subsection, these hospitals are substantially similar to the abstract service-participating hospitals in general, the group to which generalization will, of necessity, have to be confined.

4.5.2 Comparison Hospitals

Using the selection procedures described in section 4.4.8, a sample of 94 hospitals was drawn from the sample frame of all short-term, general, non-federal hospitals that met the abstracting service criterion but did not begin binding PSRO concurrent review by the end of the criterion period. Table 4.5 illustrates the relationship between (1) The universe of all short-term, general, non-federal hospitals, (2) The comparison sample frame hospitals, and (3) The sample of comparison hospitals selected for this study.

With the exception of the regional distribution, comparisons of the first two columns (all hospitals with abstracting hospitals) makes it clear that the major source of the differences observed previously for the CR sample hospitals are due to differential rates of participation of various types of hospitals in the participating abstract services and not to an interaction of CR and abstracting status. Thus it must be noted

Table 4.5

Distributions of All Hospitals and All Hospitals on Abstracting Services on Selected Hospital-Related Variables

Variable	Category	All Short-Term Hospitals (N=6272)		All Short-Term Hospitals on Abstract Service Since 1/1/74 (N=1416)	
Bedsize	6- 49	1879	(30%)	159	(11%)
	50- 99	1571	(25%)	289	(20%)
	100-199	1312	(21%)	389	(27%)
	200-299	645	(10%)	240	(17%)
	300-499	599	(10%)	254	(18%)
	500+	266	(4%)	85	(6%)
Occupancy Rate	0-64.9%	2701	(43%)	362	(26%)
	65-69.9%	766	(12%)	145	(10%)
	70-74.9%	722	(12%)	210	(15%)
	75-79.9%	771	(12%)	253	(18%)
	80%+	1312	(21%)	446	(31%)
Ownership	Govt., Non-Fed.	1921	(31%)	284	(20%)
	Non-Govt., Non-Profit	3467	(55%)	1057	(75%)
	Non-Govt., For Profit	884	(14%)	75	(5%)
Census Region	Northeast	994	(16%)	232	(16%)
	North Central	1814	(29%)	568	(40%)
	South	2269	(36%)	320	(23%)
	West	1195	(19%)	296	(21%)
SMSA	Rural (Non-SMSA)	3131	(50%)	561	(40%)
	Urban (SMSA)	3141	(50%)	855	(60%)
Teaching Status	Residency	949	(15%)	352	(25%)
	Non-Residency	5323	(85%)	1064	(75%)

that the abstract service hospitals, in comparison to all hospitals, tend to over-represent hospitals that:

- Are large;
- Have high occupancy rates;
- Are private, non-profit institutions;
- Are located in metropolitan areas; and
- Have teaching programs.

They also tend to under-represent the South and over-represent the Midwest.

The comparison sample is a representative subsample of the abstracting hospitals with respect to size, occupancy rates, ownership, and urban/rural distributions. As a result of stratification in the sampling process, the comparison sample more closely approximates the all hospital universe with respect to census region and teaching status distributions. The precautions that apply to estimates from the abstract service universe as a whole, however, apply to this subsample as well.

4.5.3 Case Study Comparison Hospitals

In conjunction with other ongoing DHEW efforts to evaluate the PSRO program, an examination was made of the PSRO areas included in the concurrent review sample in order to identify areas for which:

- A substantial proportion of the hospital beds were included within the abstract-based sample; and
- There were adjacent non-active PSRO areas in which a substantial proportion of hospital beds were covered by the same abstract services.

For these areas, additional comparison hospitals (all those in the adjacent areas and on abstract services) were included in the sample. As a consequence, it will be possible to use this data base to explore a number of regional case study comparisons.

4.5.4 Hospitals Participating

The overall consent rate for hospitals that were selected to participate in the data base was 64 percent. The two samples, however, did differ to some extent in their willingness to participate. The CR hospitals were more likely to participate -- 70 percent signed release agreements as compared to only 55 percent of the comparison hospitals. Irrespective of the

reasons for this difference (the possibilities are many), the fact that between 30 and 45 percent of the hospitals approached in each group declined to participate raises further questions about the utility of the data obtained. These questions are at least partially dispelled by an examination of the distributions in Table 4.6 which compare the sample of hospitals in each case with its respective set of participating hospitals. Only trivial differences exist between the two on each of the variables examined. In no case was the χ^2 statistic at the 10% level. Thus, although there may still be biases in self-selection, they are unlikely to cause interpretational problems with respect to those key independent variables in the analyses of these data.

The overall response rate in this study compares quite favorably with other studies that have sought to negotiate hospital release agreements. In a recent study, for example, the Institute of Medicine of the National Academy of Sciences had an overall response rate of 65%.[2]

4.5.5 Missing Data

Hospitals occasionally delay submitting their abstracted discharge data to their abstracting service for a number of months, at times even skip several months in order to try to stay current. Since the data for this study were obtained from the abstract services within five months of the close of the period for which data were desired, some hospitals had not yet completed their data reporting for that period.

All data were found to be complete through the last quarter of 1975. The number of hospitals in each of the samples missing monthly data for each of the final nine months included in the data collection period appear in Table 4.7.

Table 4.6

Comparison of Participating and Sample Hospitals on Selected Variables

Variable	Category	Concurrent Review Hospitals				Comparison Hospitals			
		Sample (N=136)		Participants (N=95)		Sample (N=94)		Participants (N=52)	
Bedsize	6- 49	12	(9%)	9	(9%)	9	(10%)	7	(13%)
	50- 99	23	(17%)	12	(13%)	13	(14%)	9	(17%)
	100-199	33	(24%)	27	(28%)	21	(22%)	10	(19%)
	200-299	33	(24%)	23	(24%)	20	(21%)	11	(21%)
	300-499	23	(17%)	16	(17%)	21	(22%)	10	(19%)
	500+	12	(9%)	8	(8%)	10	(11%)	5	(10%)
Occupancy Rate	0-49%	12	(9%)	10	(11%)	5	(5%)	2	(4%)
	50-59%	9	(7)	4	(4%)	9	(10%)	6	(12%)
	60-69%	38	(28%)	28	(29%)	19	(20%)	12	(23%)
	70-79%	42	(31%)	29	(31%)	29	(31%)	15	(29%)
	80-89%	34	(25%)	23	(24%)	25	(27%)	14	(27%)
	90%+	1	(1%)	1	(1%)	7	(7%)	3	(6%)
Recoded Occupancy Rate	0-64.9%	37	(27%)	25	(26%)	20	(21%)	12	(23%)
	65-69.9%	22	(16%)	17	(18%)	13	(14%)	8	(15%)
	70-74.9%	21	(15%)	14	(15%)	15	(16%)	7	(13%)
	75-79.9%	21	(15%)	15	(16%)	14	(15%)	8	(15%)
	80%+	35	(26%)	24	(25%)	32	(34%)	17	(33%)
Ownership	Govt., Non-Fed.	26	(19%)	15	(16%)	11	(12%)	7	(13%)
	Non-Govt., Non-Profit	98	(72%)	73	(77%)	76	(81%)	43	(83%)
	Non-Govt., For Profit	12	(9%)	7	(7%)	7	(7%)	2	(4%)
Census Region	Northeast	10	(7%)	6	(6%)	15	(16%)	8	(15%)
	North Central	47	(36%)	37	(39%)	26	(28%)	16	(31%)
	South	24	(18%)	16	(17%)	35	(37%)	19	(37%)
	West	55	(40%)	36	(38%)	18	(19%)	9	(17%)
SMSA	Rural (Non-SMSA)	34	(25%)	25	(26%)	37	(39%)	21	(40%)
	Urban (SMSA)	102	(75%)	70	(74%)	57	(61%)	31	(60%)
Teaching Status	Residency	41	(30%)	30	(32%)	16	(17%)	10	(19%)
	Non-Residency	95	(70%)	65	(68%)	78	(83%)	42	(81%)
Delegation Status	Full: CR + Recon.	45	(33%)	28	(29%)				
	Partial: CR Only	46	(34%)	31	(33%)				
	Non-Delegated	45	(33%)	36	(38%)				
PSRO Type	Statewide	42	(31%)	30	(32%)				
	Multicounty	77	(57%)	55	(58%)				
	Single County	17	(13%)	10	(11%)				
Title 18 Review Start-Up Quarter	4th 1974	6	(4%)	5	(5%)				
	1st 1975	--	--	--	--				
	2nd 1975	17	(13%)	10	(11%)				
	3rd 1975	31	(23%)	22	(23%)				
	4th 1975 (+1/1/76)	82	(60%)	58	(61%)				

Less than two percent of the hospitals in each sample were missing any data until the final quarter of the study period. The missing data rate for concurrent review hospitals was as high as 19% for September, 1976, while the rate for comparison hospitals was as high as 12% for the same month.

Table 4.7

Number of CR and Comparison Hospitals
Missing Abstract Service Data by Month

	MONTH OF 1976								
Hospital Category	1	2	3	4	5	6	7	8	9
Concurrent Review	1	1	1	2	2	2	8	11	18
Comparison	-	-	-	-	1	1	3	3	6

4.6 HOSPITALS EXCLUDED

As was described in Section 3.1.2, the time frame for the overall analysis consisted of a nine-month "Pre-Review" period and a corresponding "Post-Review" period. Of the 147 hospitals that participated in the data base development activity (95 concurrent review and 52 comparison), four were excluded from the final sample (3 concurrent review and 1 comparison) because of missing data considerations. This brought the total sample down to 92 concurrent review and 51 comparison hospitals -- a total of 143 hospitals.

Based upon Binding PSRO Review start dates (if non-binding review began 3 or more months prior to binding review then the warm-up start date was used. Source: SSA with verification of Title 18 and provision of Title 19 data by BQA regional office staff) for both Medicare and Medicaid patients, additional

Table 4.8

RESPONDING HOSPITALS IN NATIONAL GROUP N=143 STUDY 1 - C.R. 0-CONTROL

TABLE OF STUDY BY QTR18

MEDICARE

STUDY	QTR18								
FREQUENCY / PERCENT / ROW PCT / COL PCT	0	4	6	7	8	9	10	11	TOTAL
1	0	6	10	21	55	0	0	0	92
	0.00	4.20	6.99	14.69	38.46	0.00	0.00	0.00	64.34
	0.00	6.52	10.87	22.83	59.78	0.00	0.00	0.00	
	0.00	100.00	100.00	100.00	100.00	0.00	0.00	0.00	
2	46	0	0	0	0	(3)	(1)	(1)	51
	32.17	0.00	0.00	0.00	0.00	2.10	0.70	0.70	35.66
	90.20	0.00	0.00	0.00	0.00	5.88	1.96	1.96	
	100.00	0.00	0.00	0.00	0.00	100.00	100.00	100.00	
TOTAL	46	6	10	21	55	3	1	1	143
	32.17	4.20	6.99	14.69	38.46	2.10	0.70	0.70	100.00

Table 4.9

RESPONDING HOSPITALS IN NATIONAL GROUP N=143 STUDY 1 - C, P, O-CONTROL

TABLE OF STUDY BY QTR19

MEDICAID

STUDY / QTR19	0	4	6	7	8	10	11	12	TOTAL
1	4	4	6	17	50	3	7	1	92
	2.80	2.80	4.20	11.89	34.97	2.10	4.90	0.70	64.34
	4.35	4.35	6.52	18.48	54.35	3.26	7.61	1.09	
	7.27	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
2	51	0	0	0	0	0	0	0	51
	35.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.66
	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	92.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL	55	4	6	17	50	3	7	1	143
	38.46	2.80	4.20	11.89	34.97	2.10	4.90	0.70	100.00

hospitals were excluded from the Medicare and Medicaid analyses since for these hospitals, the entire data base only represented actual Pre-Review observations. Because the review start dates were in many cases different for Medicare and Medicaid patients, the hospitals excluded were not the same for both analyses. These differences and individual reasons for exclusion are outlined below.

4.6.1 Medicare Exclusions

Table 4.8 shows the frequency distribution of the participating 143 hospitals by study type (1 = CR, 2 = Non-CR) and quarter of binding Title 18 review during the "Post-Review" period. Five (5) comparison hospitals began binding PSRO review during the post period (circled). Since this would effect the Pre- vs. Post- ALOS findings for these hospitals, they were dropped from the Medicare study. In addition, one of the 10 CR hospitals that began Title 18 Review during the 6th quarter had no Medicare discharges at all (a pediatrics hospital). Hence, by default, it was not included in the Medicare analysis. This reduction brought the total number of hospitals down to 137 for Medicare -- 91 CR and 46 comparison hospitals.

4.6.2 Medicaid Exclusions

Table 4.9 shows the frequency distribution of the 143 participating hospitals by study type and quarter of binding Title 19 (Medicaid) Review. In this case, several CR hospitals either never started binding Medicaid review (the four CR hospitals in quarter "0"), or began Title 19 Review during the "Post-Review" period (circled). Again, so as not to contaminate the set of overall CR observations, these hospitals were excluded from the Medicaid analysis. Thus, we were left with a total of 128 Medicaid hospitals -- 77 CR and 51 comparison.

CHAPTER 4 FOOTNOTES

[1]The previous sample was drawn for a Social Security Administration study of PSRO Utilization and cost for Medicare beneficiaries and was provided to GRC strictly for purposes of sample design. No copy of this sample frame was retained by the Contractor.

[2]An Assessment of the Reliability of Abstracted Hospital Utilization Data, Institute of Medicine, Washington, D.C., September 1976.

5. MEDICARE UTILIZATION ANALYSIS

5.1 INTRODUCTION

In this chapter the analysis and findings related to the effects of PSRO concurrent review activity on Medicare utilization are presented. The analysis is discussed in six major sections according to the type of utilization dependent variable under investigation.

The first analytical section (5.2) describes the impact of concurrent review activity on the average length of stay (ALOS) of Medicare patients for all patients and for twenty-one diagnoses selected for closer scrutiny. This analysis employs the concept of expected length of stay (ELOS) for matched patients which is explained fully in the Methodology chapter of this report.

Section 5.3 focuses on the changes in the LOS distribution that may be attributable to the concurrent review activity. This analysis is particularly important because of the lack of sensitivity of ALOS as a measure of changes in the distribution of lengths of stays. Measures of the length of stay distribution used in the analysis are the percent of short stays and the percent of long stays for Medicare patients. Short stays are defined as the number of patients with stays less than the fifth percentile for matched patients as described in the study methodology. Long stays are defined as the number of patients with stays greater than the seventy-fifth percentile for matched patients.

The third section (5.4) of the analysis examines changes in the diagnostic mix between the pre-review and post-review time periods for the concurrent review and comparison hospitals. Section 5.5 considers the number of discharges and the number of patient days as the dependent variables. Because of the lack of any appropriate denominator data specific to individual

hospitals as the unit of analysis, it was impossible to examine changes in the number of discharges per 1000 eligible population or the number of patient days of care per 1000 eligible population. Therefore, the analysis of discharges and patient days is severely limited in terms of any inferences that may be drawn about the impact of concurrent review activity on these aspects of hospital utilization.

The fifth section (5.6) of the analysis briefly examines three types of patient discharges that were excluded from the main analysis. The excluded patient categories are transfers, deaths, and patients with stays over 100 days. These sets of patients are examined for changes that occurred between the pre-review and post-review time periods and between concurrent review and comparison hospitals.

The final section of the Medicare utilization analysis investigates the relationships between changes in the length of stay and the severity levels of a disease, as measured by the "staging index," for concurrent review hospitals and comparison hospitals in the pre-review and post-review time periods. The stage of disease is used as a stratification variable in an attempt to more fully control for the medical characteristics of the patient's condition and, thus, obtain as homogeneous a patient population as possible in order to examine the effects of concurrent review activity on the length of patient stay.

5.2 AVERAGE LENGTH OF STAY ANALYSIS

The primary purpose of the analysis of average length of stay is to evaluate the effectiveness of concurrent review activity in changing the ALOS of hospital patients.

Four major hypotheses were formulated to test the relationship between

PSRO concurrent review activity and changes in ALOS. These principal hypotheses are stated below in null hypotheses form.

H_1 CHANGES IN AVERAGE LENGTH OF STAY BETWEEN PRE-REVIEW AND POST-REVIEW PERIODS ARE ZERO FOR CONCURRENT REVIEW HOSPITALS.

NOTE: This hypothesis will be tested for 22 diagnosis groups and for all diagnoses.

H_2 CHANGES IN AVERAGE LENGTH OF STAY BETWEEN PRE-REVIEW AND POST-REVIEW PERIODS ARE EQUAL FOR CONCURRENT REVIEW HOSPITALS AND COMPARISON HOSPITALS.

NOTE: This hypothesis will be tested for 22 diagnosis groups and for all diagnoses.

H_3 CHANGES IN AVERAGE LENGTH OF STAY BETWEEN PRE-REVIEW AND POST-REVIEW PERIODS FOR CONCURRENT REVIEW HOSPITALS ARE INDEPENDENT OF OTHER HOSPITAL CHARACTERISTICS.

NOTE: This hypothesis will be tested for the independent variables listed in H_4 with the addition of the following variable: Review delegation status.

H_4 CHANGES IN AVERAGE LENGTH OF STAY BETWEEN PRE-REVIEW AND POST-REVIEW PERIODS FOR CONCURRENT REVIEW HOSPITALS VERSUS COMPARISON HOSPITALS ARE INDEPENDENT OF OTHER HOSPITAL CHARACTERISTICS.

NOTE: This hypothesis will be tested using the following hospital characteristics as independent variables:

- Teaching status of the hospital
- Occupancy rate of the hospital
- Short-term beds in the hospital

- M.D.S. per 1000 population in the county
- Extended care beds per 1000 population in the county
- Short-term beds
- Percent federal patients discharged from the hospital
- Percent federal patient days

As discussed in the methodology chapter, a Pre-test, Post-test-Experimental, Control research design was selected as the most powerful evaluative tool available to examine the major hypotheses given the limitations of the data, as well as the short time period available for analysis.

Before the results of the statistical tests of the hypotheses are given, some basic characteristics of the trends in ALOS for the concurrent review and comparison hospitals are described.

5.2.1 Trends in Average Length of Stay

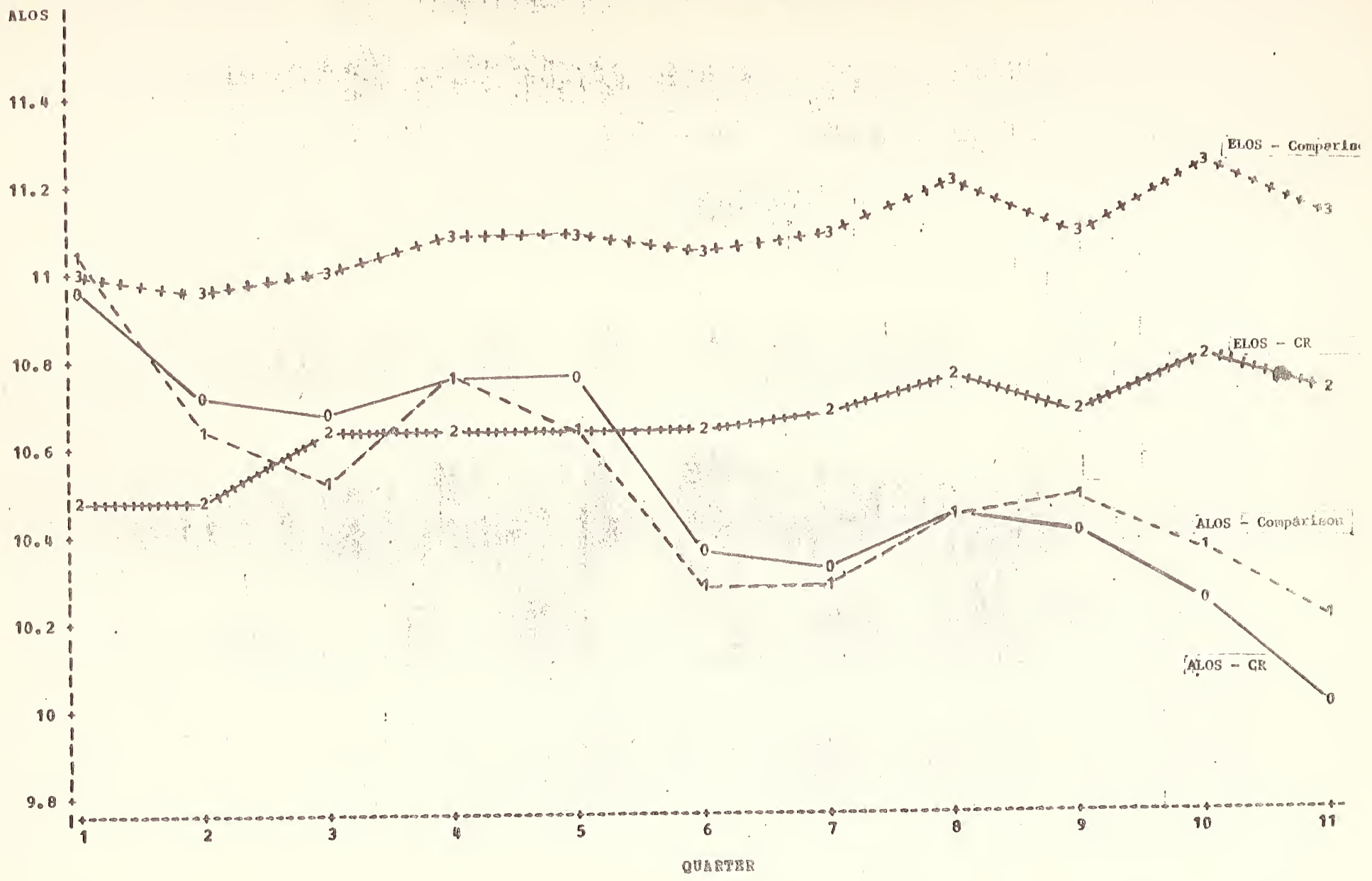
The analysis of the impact of concurrent review activity on ALOS is particularly difficult in light of the declining trend in ALOS in recent years. This secular decline is evident over the eleven quarter time period included in this study (1st quarter, 1974 through 3rd quarter, 1976) for both the concurrent review hospitals and the comparison hospitals. Figure 5.1 plots the trends in the mean ALOS weighted by the number of patients in each hospital by quarter, for the concurrent review and comparison hospitals over the time period. Included in the plot is the expected length of stay (ELOS) as calculated for matched patients from the 1975 PAS reference data base.

Inspection of the trends show that ALOS for patients in the concurrent

ACTUAL (0,1) AND EXPECTED (2,3) LENGTHS OF STAY BY QUARTER
FOR STUDY (0,2) AND COMPARISON (1,3) HOSPITALS --- MEDICARE

PLOT OF QUARTER*ALOS LEGEND: SYMBOL IS VALUE OF STYPE
PLOT OF QUARTER*ELOS LEGEND: SYMBOL IS VALUE OF STYPE2

QUARTER = STUDY QUARTER: 1-1974/1,...,11-1976/3 ALOS = AVERAGE LENGTH OF STAY ELOS = EXPECTED L.O.S.



review hospitals for all diagnoses declined 8.9% from 10.97 days in the first quarter of 1974 to 9.99 days in the third quarter of 1976. Although marked by some apparent variation with the first and fourth quarters generally experiencing a higher ALOS than the second and third quarters, the decline in the ALOS has been relatively uniform over the time period.

A similar trend is observed for the comparison hospitals where the ALOS has declined 7.4% from 11.03 days to 10.22 days over the same period.

Comparison of the trends shows several interesting features in addition to those already mentioned in the generally declining trend. It is also apparent that the concurrent review hospitals and comparison hospitals track rather closely over the time period with two exceptions. It would appear that during the first three quarters of 1974 the comparison hospitals were experiencing a somehwat sharper decline in ALOS than were the concurrent review hospitals. However, during 1976, the ALOS in the concurrent review hospitals was declining more rapidly than was the ALOS in the comparison group. It is also important to note that the ALOS for the concurrent review hospitals was higher than the ALOS for the comparison hospitals in all quarters prior to 1976 (with the exception of the first quarter of 1974). By the end of 1976, the ALOS in the concurrent review hospitals dropped below the comparison hospitals by almost one-fourth day.

One of the most interesting characteristics of the trends for both hospital groups is the substantial decline in ALOS that occurred between the first and second quarters of 1975. No other decrease in ALOS between successive quarters is as large. It should be noted that this decline occurred prior to many hospitals implementing concurrent review activity

and occurred in both the concurrent review and comparison hospital groups. It would appear that the ALOS for both groups reached two plateaus during the time period; with the first lasting between the second quarter of 1974 and the first quarter of 1975, and the second beginning in the second quarter of 1975 and continuing perhaps until the first quarter of 1976.

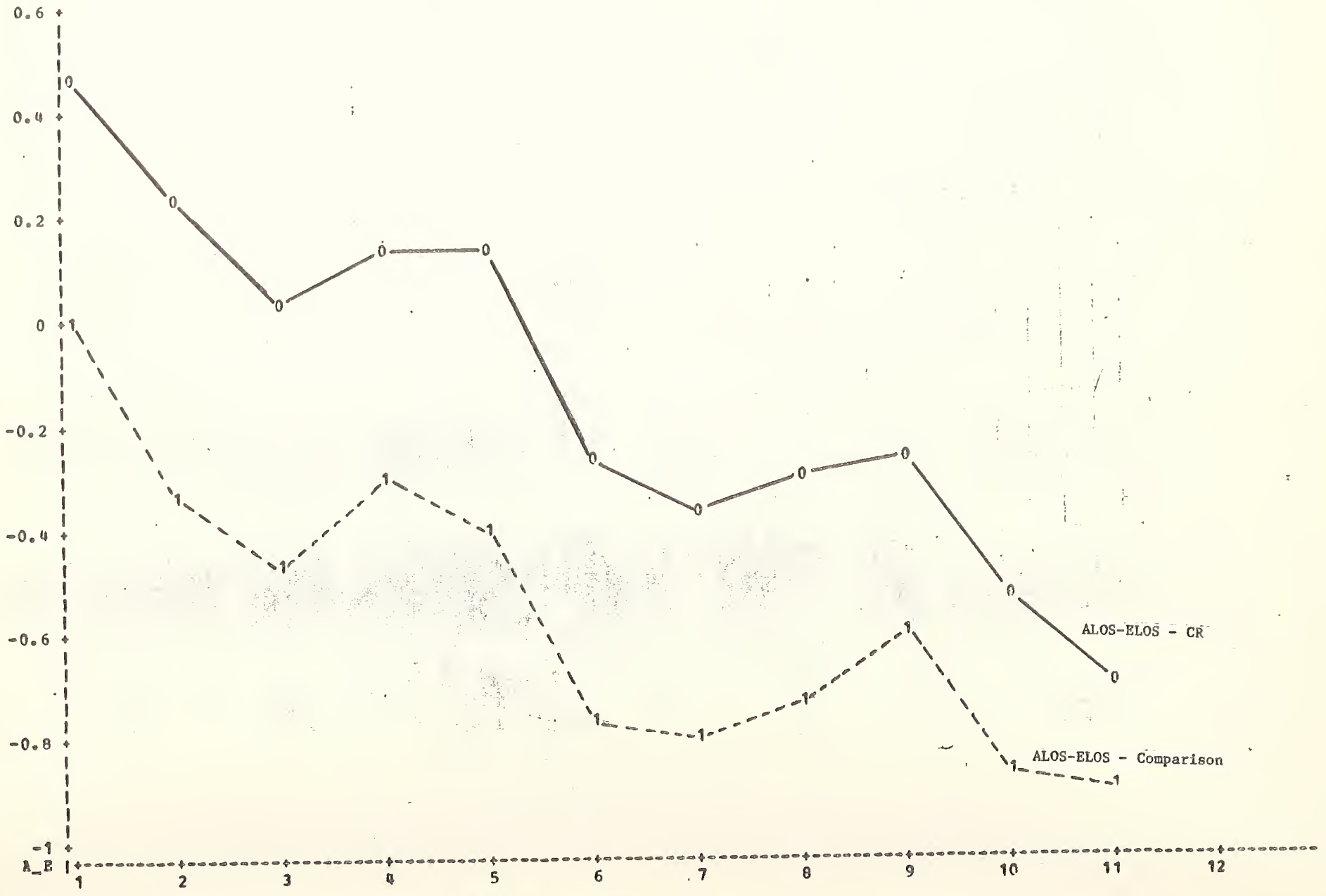
Also plotted in Figure 5.1 is the expected length of stay (ELOS) for the concurrent review and comparison hospital groups. As previously described, the ELOS calculation is based on the 1975 PAS reference data base. Although the ELOS trends for the hospital groups are quite stable over time (approximately a zero slope) reflecting not much of a change in the patient case mix, the difference between the ELOS for the concurrent review hospitals and comparison hospitals is substantial (.52 days in the first quarter of 1974) with a higher ELOS for the comparison group. Because the ELOS is based on regional norms as well as on patient characteristics, the difference in ELOS for the two hospital groups reflects the higher concentration in the sample of concurrent review hospitals from the Western states where the length of stay is typically lower. The ALOS for the concurrent review and comparison hospitals began the period at approximately the same level as the ELOS for the comparison group. While the ALOS and ELOS for the comparison group were almost the same, the ALOS for the concurrent review group was initially almost half a day above its group's ELOS. It would appear that over the time period the ALOS for the comparison group behaved more like the ALOS for the concurrent review hospital group than it did for its ELOS based on patient characteristics and regional norms.

Figure 5.2 presents the trends in the difference: ALOS minus ELOS (ALOS-ELOS) for the concurrent review and comparison hospitals. The plot shows that the decline in ALOS-ELOS is somewhat sharper for the concurrent review group than for the

Figure 5.2

ACTUAL MINUS EXPECTED LENGTHS OF STAY BY QUARTER
FOR STUDY (0) AND COMPARISON (1) HOSPITALS --- MEDICARE

PLOT OF QUARTER*A_E LEGEND: SYMBOL IS VALUE OF STYPE



comparison group over the time period.

A linear regression analysis was performed using ALOS corrected for ELOS as the dependent variable to determine the value of slopes of the best fit lines for the concurrent review and comparison hospitals and to test for the significance of the differences betreen the two slopes. The results of the analysis are given in Table 5.1. Similar results are obtained for the slopes of the best fit lines independent of whether ALOS is corrected for ELOS in the regression equation or whether the dependent variable ALOS-ELOS is used. In both cases the concurrent review hospitals exhibited a greater negative slope than the comparison hospitals; however, the difference in the slopes between the comparison and concurrent review hospitals was not statistically significant as shown by the t-values and their associated probabilities. Therefore, over the total time period, ALOS and ALOS-ELOS are declining for the concurrent review and comparison hospitals; however, both hospital groups are declining at approximately the same rate.

In the analysis of changes in ALOS, it became evident that the start-up dates for binding Title 18 concurrent review differed considerably for the 91 hospitals in the concurrent review sample. Six institutions began review during the fourth quarter of 1974; nine hospitals in the second quarter of 1975; 21 hospitals in the third quarter of 1975; and 55 hospitals beginning review during the last quarter of 1975 or the first five days of 1976. Therefore, of the 91 concurrent review hospitals, over 60 percent have begun review within the last few months of 1975. Thus, a maximum of three quarters of post review experience is available for the evaluation. Four hospital cohorts were defined according to the Title 18 review date start up quarter described above. Figure 5.3 plots the ALOS by quarter for the four hospital cohorts. It is readily

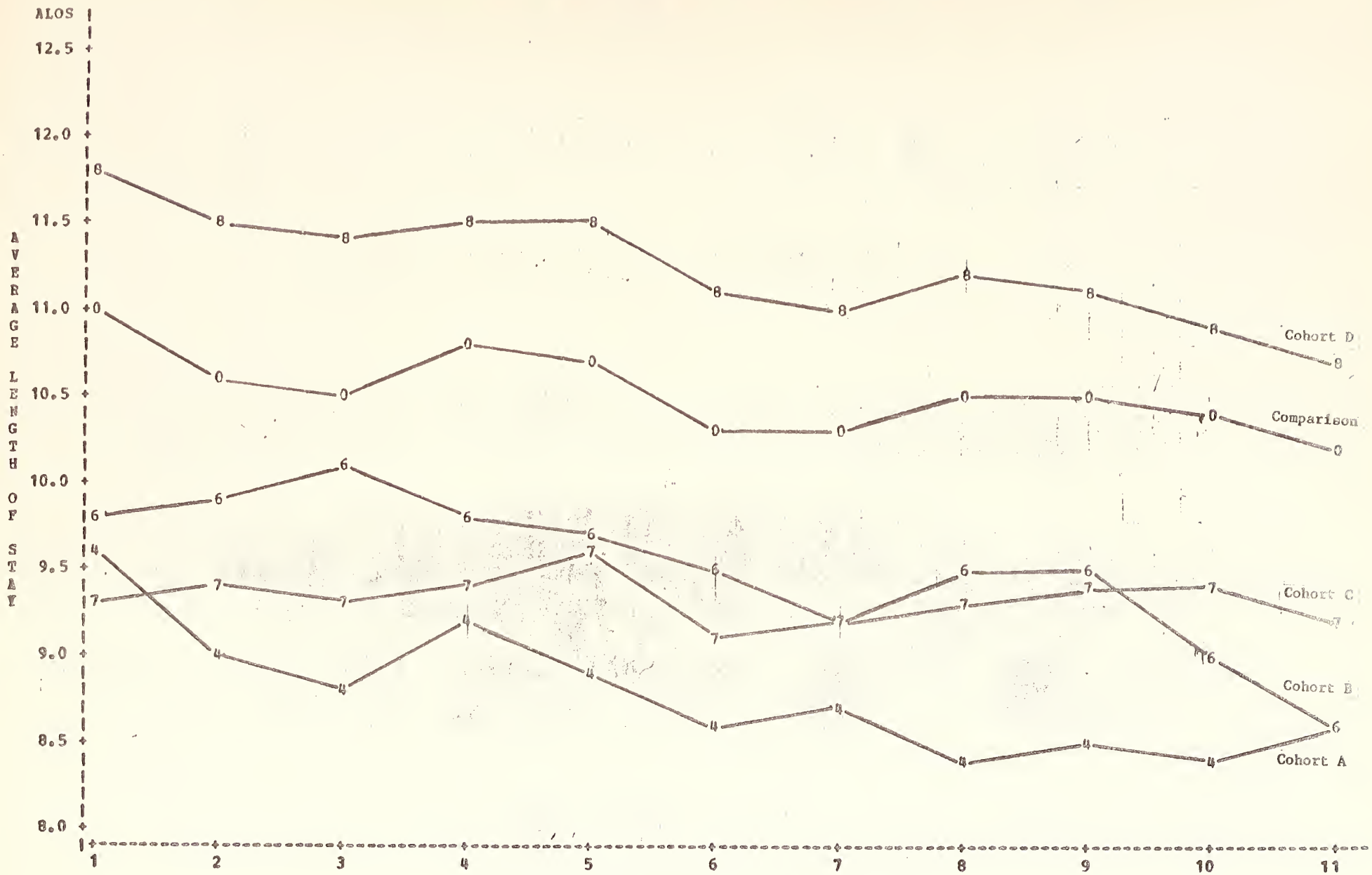
TABLE 5.1

TEST OF DIFFERENCES IN SLOPES OF ALOS (CORRECTED FOR ELOS)
AND ALOS-ELOS BETWEEN CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DEPENDENT VARIABLE	NUMBER OF OBSERVATIONS	SLOPE CR HOSPITALS	SLOPE COMPARISON HOSPITALS	DIFFERENCES IN SLOPE COMPARISON-CR	t-VALUE	P-VALUE
ALOS	11	-0.102	-.075	0.027	1.44	0.17
ALOS-ELOS	11	-0.103	-.076	0.027	1.52	0.15

OBSERVED LENGTH OF STAY BY QUARTER FOR HOSPITAL MEDICARE REVIEW COHORTS
C.R. START DATES: 4-1974.4, 6-1975.2, 7-1975.3, 8-1975.4/COMPARISONS: 0

PLOT OF QUARTER*ALOS LEGEND: SYMBOL IS VALUE OF QTR18



QUARTER = STUDY QUARTER 1 THRU 11 1-1974.1 ETC.

apparent that cohort D, which began review in fourth quarter of 1975, is significantly different from cohorts A, B, and C in the absolute level of ALOS over the time period. The ALOS for cohort D is also higher than the comparison hospital group over the entire time period. This difference may, in part, be explained in that the hospitals in cohort D are predominantly (36 of 55 hospitals) from the North-East and North-Central census regions where the ALOS has been traditionally higher than in the West and South regions.[1]

Cohort A, which was the earliest group of hospitals to begin concurrent review, experienced an ALOS that was below the other cohorts for all quarters except the first and last quarters of the time period. Part of the explanation for the overall low ALOS for cohort A may be that 5 of the 6 hospitals in this cohort are from the West census region. The ALOS for Medicare patients in hospital cohort A has appeared to level off during the last five quarters of the time period perhaps reflecting a "floor" value for ALOS of approximately 8.5 days. It would also appear that, given the ALOS of cohort A in 1974 relative to the other hospital cohorts, the length of stay had already been pushed downward prior to the start up of Title XVIII binding review in the fourth quarter of 1974. This may have occurred as a result of utilization review programs that predated Title XVIII binding review or just a continuation of a general secular trend in ALOS for these hospitals that had been continuing since before 1974. However, neither the hospital utilization review program characteristics nor historical utilization data are available to examine these issues in any detail in this study. After the Title XVIII binding review start date for cohort A, (quarter 4) the ALOS declined in the subsequent two quarters and has not changed appreciably since that time.

Patients in hospital cohorts B and C exhibit a sharply declining ALOS

for the quarters close to the end of the study time period. For cohort B, which began review in the second quarter of 1975, three quarters elapsed after review began before a downward trend in ALOS was observed - a sharp drop in ALOS occurred in both the second and third quarters of 1976 with ALOS going from 9.58 days in the first quarter of 1976 to 8.6 days by the end of the study period. By the end of the period the ALOS for cohort B was the lowest of any other cohort.

Cohort C also experienced a decline in ALOS at the end of the study period although less than that observed for cohort B. The ALOS for the cohort rose slightly for three quarters after the beginning of review in the third quarter of 1975. However, in the fourth quarter following review, the ALOS dropped somewhat from 9.4 to 8.8 days, similar in pattern to the decline observed for cohort B during that period. By the end of the time period, cohorts A, B, and C had average lengths of stay within one-half day of one another.

The quarterly trend in ALOS for cohort D after Title 18 review began in the fourth quarter of 1975 was very similar to the declining trend observed for the period prior to review. No sharp drop off is observed for cohort D as was evidenced in cohort B. Rather, the decline in ALOS after review began continued to be gradual and steadily downward. It would appear that the rate of decline was somewhat greater for cohort D than for the comparison hospitals. It should be noted that only three quarters had elapsed between the beginning of binding review for hospitals in cohort D and the end of the study period. The declines in ALOS for hospitals in cohorts B and C did not take place until the fourth quarter following review. Therefore, although the data is certainly not definitive, it may be early to expect

to see the effect of concurrent review activity on changes in ALOS for hospitals in cohort D.

Table 5.2 provides the ALOS for concurrent review and comparison hospitals by quarter and for each of the concurrent review hospital cohorts.

5.2.2 Pre-Post Analysis of ALOS

As described in the methodology chapter of this report, the relatively short post review period for the hospitals included in the sample substatially limited the analyses that could be undertaken. For the total concurrent review hospital sample, the only post period available was the first three quarters of 1976. Because some hospitals in the sample (cohort A) began review as early as the fourth quarter of 1974, the pre review period was, by necessity, defined as the first three quarters of 1974. When the changes in length of stay between the pre and post periods for concurrent review hospitals and comparison hospitals was examined, it was found that the ALOS declined somewhat more for the concurrent hospitals than for the comparison hospitals. When the change in (ALOS-ELOS) was examined, a similar pattern was found. Table 5.3 presents the change measures pre and post for the adjusted ALOS and ALOS-ELOS variables for both hospital groups. While the comparison hospitals experienced a decline in the ALOS of -.36 days, the concurrent review hospitals experienced a greater decline of -.57 days, yielding a net difference of -.21 days in favor of the concurrent review group. For the ALOS-ELOS variable, which controls for patient risk characteristics, the decline was -.75 for concurrent review hospitals versus -.52 for comparison hospitals resulting in a similar net difference of -.23 days. In either case, the net differences between the two hospital groups was almost one-fourth of a patient day

TABLE 5.2

ALOS BY QUARTER FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS AND BY START UPDATE OF BINDING TITLE 18 REVIEW: MEDICARE PATIENTS

QUARTER / HOSPITAL GROUP	1974				1975				1976		
	1	2	3	4	1	2	3	4	1	2	3
CONCURRENT REVIEW HOSPITALS COHORT A: 4TH QTR 74 REVIEW START	9.62	9.00	8.82	9.16	8.89	8.62	8.69	8.43	8.48	8.43	8.59
COHORT B: 2ND QTR 75 REVIEW START	9.79	9.93	10.08	9.79	9.69	9.53	9.16	9.46	9.48	9.00	8.60
COHORT C: 3RD QTR 75 REVIEW START	9.33	9.44	9.31	9.42	9.62	9.12	9.24	9.29	9.36	9.35	9.15
COHORT D: 4TH QTR 75 REVIEW START	11.85	11.45	11.41	11.51	11.49	11.08	11.03	11.20	11.07	10.89	10.72
ALL CR HOSPITALS	10.97	10.73	10.69	10.77	10.75	10.37	10.32	10.46	10.40	10.25	9.99
COMPARISON HOSPITALS	11.03	10.63	10.53	10.77	10.65	10.28	10.26	10.45	10.46	10.37	10.21

TABLE 5.3

CHANGE IN ALOS FOR
CONCURRENT REVIEW AND COMPARISON HOSPITALS; MEDICARE

HOSPITAL GROUP	PRE-REVIEW (1st,2nd,3rd Qtr 1974)			POST REVIEW (1st,2nd, 3rd Qtr 1976)			DIFFERENCE	
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS)POST (ALOS)PRE	(ALOS-ELOS)POST -(ALOS-ELOS)PRE
CONCURRENT REVIEW HOSPITALS	10.79	10.55	.25 ($\hat{\beta}_0$)	10.22	10.72	-0.50	-0.57	-0.75 ($\hat{\beta}_2$)
COMPARISON HOSPITALS	10.72	10.99	-.27 ($\hat{\beta}_0+\hat{\beta}_1$)	10.36	11.14	-0.79	-0.36	-0.52 ($\hat{\beta}_2 + \hat{\beta}_3$)
NET DIFFERENCE (COMPARISON-CONCURRENT REVIEW)	-.07	+.44	-.52 ($\hat{\beta}_1$)	+.14	+.42	-.29	+.21	+0.23 ($\hat{\beta}_3$)

for all discharges included in the study.

Table 5.4 shows the number and percent of hospitals by direction of change in the ALOS and ALOS-ELOS measures for the concurrent review and comparison groups. Of the 91 concurrent review hospitals included in the sample, 64 (70.3%) experienced declines in the ALOS between the pre-review and post-review time periods while 28.6% of the hospitals increased their length of stay. A somewhat smaller proportion of the comparison hospitals was successful in reducing their ALOS (67.4%). When the ALOS-ELOS measure is examined, a similar pattern occurs with 80.2% of the concurrent review hospitals showing decreases in ALOS between the pre-review and post-review time periods compared with 76.1% of the comparison hospitals. Therefore, with both measures, a slightly larger proportion of the concurrent review hospitals experienced decreases in ALOS than did the comparison hospitals. However, a Chi square test shows that there is no statistically significant interaction between the proportion of hospitals experiencing decreases in ALOS and the presence of PSRO CR activities (X^2 = 0.124 for ALOS and X^2 = 0.313 for ALOS-ELOS).

TABLE 5.4

NUMBER AND PERCENT OF HOSPITALS BY DIRECTION OF CHANGE IN ALOS AND ALOS-ELOS FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

HOSPITAL GROUP / DIRECTION OF CHANGE		(ALOS)POST - (ALOS)PRE			TOTAL
		< 0	= 0	> 0	
CONCURRENT REVIEW HOSPITALS	N	64	1	26	91
	%	70.3	1.1	28.6	100%
COMPARISON HOSPITALS	N	31	0	15	46
	%	67.4	0.0	32.6	100%
TOTAL		95	1	41	137

CHI-SQUARE = 0.124, P= .7246, D.F=1 (For 2x2 Table with 0 and >0 categories combined)

HOSPITAL GROUP / DIRECTION OF CHANGE		(ALOS-ELOS)POST - (ALOS-ELOS)PRE			TOTAL
		< 0	= 0	> 0	
CONCURRENT REVIEW HOSPITALS	N	73	0	18	91
	%	80.2	0.0	19.8	100%
COMPARISON HOSPITALS	N	35	0	11	46
	%	76.1	0.0	23.9	100%
TOTAL		108	0	29	

CHI-SQUARE = 0.313, P=0.3760 DF=1 (For 2x2 Table with 0 and >0 categories combined)

Statistical significance of observed changes in the ALOS and ALOS-ELOS dependent variables was tested using a linear regression model. The rationale for the regression model was discussed in the methodology chapter. The equations for the basic regression models are as follows:

$$ALOS = \beta_0 + \beta_1 STYPE + \beta_2 TIME + \beta_3 (STYPE \cdot TIME) + \beta_4 ELOS + \varepsilon$$

$$ALOS\text{-}ELOS = \beta_0 + \beta_1 STYPE + \beta_2 TIME + \beta_3 (STYPE \cdot TIME) + \varepsilon$$

Where: ALOS: Average length of Stay

ELOS: Expected Length of Stay

STYPE: Hospital Type

0 = Concurrent Review Hospital

1 = Comparison Hospital

TIME: Review Period

0 = Pre-Review (1st, 2nd, 3rd quarters of 1974)

1 = Post-Review (1st, 2nd, 3rd quarters of 1976)

STYPE·TIME: Cross Product of Hospital Type and Time

The coefficient β_1 of the STYPE term measures the effects of the hospital type on the dependent variables of ALOS and ALOS-ELOS. Specifically, the coefficient represents the difference in the ALOS or ALOS-ELOS between the concurrent review hospitals and the comparison hospitals in the pre-review period. The β_2 coefficient of the TIME term measures the effects of time on the dependent variables and represents the change in the ALOS or ALOS-ELOS for the set of concurrent review hospitals between the pre-review and post-review periods.

The coefficient β_3 of the cross product term of STYPE·TIME on the regression equation measures the interaction of the hospital type and time on the dependent variables and is the most significant term to determine the net effects of concurrent review activity in the evaluation design.

The ELOS term with the β_4 coefficient in the ALOS equation is used in an

attempt to remove the effects of variations in patient risk factors including diagnosis group, whether the patient had single or multiple diagnosis, patient age, and whether the patient was operated or not operated. As described in the methodology, the dependent variables are weighted in the regression by the square root of the number of discharges in order to adjust for differences in the number of patients between hospitals and diagnosis groups.

The results of the regression analysis for the ALOS and ALOS-ELOS dependent variables are given in Table 5.5. The estimated regression coefficient for the ELOS variable in the ALOS equation is 0.99659 with a standard error of 0.09512, thus indicating that the ELOS serves exceedingly well as a risk adjustment index. That is, by considering each patient's diagnosis group, age, single versus multiple diagnosis, and operation status, the CPHA expected length of stay algorithm appears to be performing quite well as a predictor of ALOS. This result suggests that any additional measurable effects of other factors will not be influenced by differences in patient risk profiles between hospitals and time periods. Moreover, because the value of the constant term is very close to zero (0.28740 with a standard error of 0.09512), the relationship between ALOS and ELOS is effectively 1:1.

As a result of this homogeneous relationship, the two different specifications of the regression equation (i.e., either using ALOS or ALOS-ELOS as the dependent variable) yield virtually identical estimates for the remaining variables. For example, both specifications yield an estimated coefficient of -0.52 ($\hat{\beta}_1$) for the STYPE variable. Recalling the interpretation of β_1, previously described, we conclude that ALOS was, on the average, 0.52 days lower in the comparison hospitals than in the concurrent review hospitals during the three quarter pre-review period. Similarly, identical estimates are obtained for ALOS and ALOS-ELOS for the TIME coefficient ($\hat{\beta}_2 = -0.75$), indicating that ALOS declined

TABLE 5.5

Analysis Results of the Relationship Between
Average Length of Stay, Expected Length of Stay, Hospital Review Type, and Time

Dependent Variable: ALOS

FORM: $ALOS = \beta_0 + \beta_1 STYPE + \beta_2 TIME + \beta_3 (STYPE \cdot TIME) + \beta_4 ELOS + \varepsilon$

NUMBER OF OBSERVATIONS = 13,382
DEGREES OF FREEDOM = 13,377

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
β_0 CONSTANT	0.28739908	3.02	0.0025	0.09512106
β_4 ELOS	0.99659260	121.80	0.0001	0.00818197
β_1 STYPE	-0.52069672	-7.76	0.0001	0.06710452
β_2 TIME	-0.76409911	-13.44	0.0001	0.05685637
β_3 S X T	0.22726752	2.48	0.0133	0.09181975

Dependent Variable: ALOS-ELOS

FORM: $ALOS = \beta_0 + \beta_1 STYPE + \beta_2 TIME + \beta_3 (STYPE \cdot TIME) + \varepsilon$

NUMBER OF OBSERVATIONS = 13,382
DEGREES OF FREEDOM = 13,378

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
β_0 CONSTANT	0.25153497	6.28	0.0001	0.04005715
β_1 STYPE	-0.52238869	-7.80	0.0001	0.06700528
β_2 TIME	-0.76483518	-13.48	0.0001	0.05683804
β_3 S X T	0.22748206	2.48	0.0132	0.09182118

on the average by 0.75 days between the pre-review and post-review periods for concurrent review hospitals. The decrease in ALOS for the comparison hospitals was -0.52 days ($\hat{\beta}_2 + \hat{\beta}_3 = -0.75 + 0.23 = -0.52$). Therefore, while ALOS also decreased for the comparison hospitals, it decreased on the average by $\hat{\beta}_3 = 0.23$ days less than the concurrent review hospitals. Thus it appears that PSRO concurrent review activities had an additional impact on reducing ALOS relative to the comparison hospitals.

Turning next to the levels of statistical significance given in Table 5.5, we find that all of the coefficients were statistically significant at the $p<.05$ level. Specifically, the .75 decrease in ALOS between the pre-review and post-review periods for the concurrent review hospitals was significant with $p = 0.0001$. The added impact of 0.23 days for the concurrent review compared with the comparison hospitals was statistically somewhat less significant with $p = 0.0133$; however, it would appear that the $\hat{\beta}_3$ coefficient of 0.23 days is a reliable estimate of the net reduction in ALOS as a result of the concurrent review activity over the time period. Near-identical results are obtained when the regression results using ALOS-ELOS as the dependent variable are examined. An additional regression model was run to test whether these observed differences in ALOS (and ALOS-ELOS) may have resulted from bias in the sampling plan leading to an overrepresentation of certain types of hospitals in the comparison group. The results of that regression analysis which controlled for selected hospital and catchment area characteristics (Table 5.10I, bottom line) were consistent with the findings shown in Table 5.5.

Therefore, the principal finding of the analysis is that there is sufficient evidence to reject the null hypothesis that there were equal changes in the average length of stay between pre-review and post-review periods for PSRO concurrent review and comparison hospitals. PSRO concurrent review hospitals experienced a signif-

icantly greater decrease in ALOS (and ALOS-ELOS) than the comparison hospitals. It would appear that, although much of the variance in ALOS is explained by the ELOS term and the secular trend over time, which is supported by the trend analysis, there is nevertheless a detectable and statistically significant impact of PSRO concurrent review activity in reducing overall hospital length of stay.

Although the .23 day reduction in average length of stay is statistically significant, the question of whether or not the decrease is significant from a programmatic and cost containment perspective remains to be answered through considerations of the policy implications of the observed ALOS reduction with respect to other PSRO program effects and program cost.

5.2.3 Diagnostic Specific Pre-Review, Post-Review Analysis of ALOS

Twenty-two diagnostic groups were examined to determine if the statistically significant relationship between concurrent review activity and the decrease in ALOS described in the previous section was found to hold for specific diagnoses.

Table 5.6 presents the descriptive findings of the diagnosis group analysis. The table includes measures of ALOS, ELOS, ALOS-ELOS for the pre-review and post-review periods for concurrent review and comparison hospitals. The post minus pre differences for the ALOS and ALOS-ELOS measures are also given.

Of the twenty-two diagnosis groups, nineteen showed a decrease in either the ALOS or ALOS-ELOS measure for the concurrent review hospitals between the pre-review and post-review periods. Twelve groups experienced a decline of one-half day or more for the concurrent review hospitals. Those twelve diagnosis groups are listed below:

Dx #	Diagnosis Group	Concurrent Review Hospitals ALOS Decrease	ALOS-ELOS Decrease
1.	Hypertension	- .26	- .58
5.	Ulcer	- .75	-1.69
6.	Cholecystitis/Choletithiasis	- .47	- .54
7.	Inguinal Hernia	- .59	- .68
8.	Hyperplasia Prostate	- .53	- .62
11.	Cerebrovascular Disease	- .72	- .47
12.	Chronic Ischemic Heart Disease	-1.20	-1.32
13.	Acute Myocardial Infarction	-1.97	-1.98
15.	Malignant Neoplasm of Breast	- .58	- .96
19.	Cataract	-1.05	-1.04
21.	Appendicitis	-1.45	-1.71
22.	Other	- .57	- .74

Only two diagnoses experienced increases in both the ALOS and ALOS-ELOS measures for the concurrent review hospitals: Complications and Adverse Reactions (Dx #10); and Neuroses (Dx #20).

TABLE 5.6

CHANGE IN ALOS BY DIAGNOSIS GROUP
FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DIAGNOSTIC GROUP AND HOSPITAL GROUP	PRE-REVIEW			POST-REVIEW			DIFFERENCE	
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS)POST (ALOS)PRE	(ALOS-ELOS)POST -(ALOS-ELOS)PRE
DX GROUP 1: HYPERTENSION								
CR. HOSPITALS	9.50	9.44	.06	9.24	9.76	- .52	- .26	- .58
COMPARISON HOSPITALS	10.50	9.87	.17	9.26	10.02	- .76	- .79	- .93
DX GROUP 2: PNEUMONIA								
CR HOSPITALS	11.63	11.74	- .11	11.39	11.84	- .46	- .24	- .35
COMPARISON HOSPITALS	12.47	12.44	.27	12.26	12.48	- .22	- .21	- .49
DX GROUP 3: HEART FAILURE								
CR HOSPITALS	11.72	11.70	.02	11.65	11.83	- .18	- .07	- .20
COMPARISON HOSPITALS	12.14	12.00	.15	11.65	12.19	- .53	- .49	- .68
DX GROUP 4: URINARY TRACT INFECTION								
CR HOSPITALS	8.47	8.78	- .32	8.33	8.97	- .64	- .14	- .32
COMPARISON HOSPITALS	8.63	8.90	- .27	7.96	8.88	- .92	- .67	- .65
DX GROUP 5: ULCER								
CR HOSPITALS	12.52	11.28	1.23	11.77	12.23	- .46	- .75	-1.69
COMPARISON HOSPITALS	11.68	11.67	.01	11.24	12.42	-1.17	- .44	-1.18
DX GROUP 6: CHOLECYSTITIS/ CHOLETITHIASIS								
CR HOSPITALS	12.57	12.25	.32	12.10	12.34	- .24	- .47	- .54
COMPARISON HOSPITALS	12.56	12.46	.10	12.32	12.79	- .47	- .23	- .57

TABLE 5.6 (Cont'd)

CHANGE IN ALOS BY DIAGNOSIS GROUP
FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DIAGNOSTIC GROUP AND HOSPITAL GROUP	PRE-REVIEW			POST-REVIEW			DIFFERENCE	
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS)POST (ALOS)PRE	(ALOS-ELOS)POST -(ALOS-ELOS)PRE
DX GROUP 7: INGUINAL HERNIA								
CR HOSPITALS	7.70	7.32	.39	7.11	7.40	- .29	- .59	- .68
COMPARISON HOSPITALS	8.15	7.59	.56	7.37	7.61	- .24	- .78	- .80
DX GROUP 8: HYPERPLASIA PROSTATE								
CR HOSPITALS	10.80	10.41	.40	10.27	10.49	- .22	- .53	- .62
COMPARISON HOSPITALS	11.63	10.96	.67	10.64	10.89	- .25	- .99	- .92
DX GROUP 9: DISC, DISPLACEMENT								
CR HOSPITALS	13.77	12.92	.84	13.99	13.44	.55	+ .22	- .29
COMPARISON HOSPITALS	12.10	13.07	- .97	11.69	13.24	-1.55	- .41	- .58
DX GROUP 10: COMPLICATIONS & ADVERSE REACTIONS								
CR HOSPITALS	8.80	9.82	-1.02	9.38	10.21	- .83	+ .58	+ .19
COMPARISON HOSPITALS	9.33	10.12	- .79	8.61	10.28	-1.68	- .72	- .89
DX GROUP 11: CEREBROVASCULAR DISEASE								
CR HOSPITALS	10.66	11.29	- .63	9.94	11.04	-1.10	- .72	- .47
COMPARISON HOSPITALS	10.48	11.69	-1.22	10.41	11.24	- .82	- .07	+ .40

TABLE 5.6 (Cont'd)

CHANGE IN ALOS BY DIAGNOSIS GROUP
FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DIAGNOSTIC GROUP AND HOSPITAL GROUP	PRE-REVIEW			POST-REVIEW			DIFFERENCE	
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS)POST-(ALOS)PRE	(ALOS-ELOS)POST-(ALOS-ELOS)PRE
DX GROUP 12: CHRONIC ISCHEMIC HEART DISEASE								
CR HOSPITALS	11.13	10.37	.76	9.93	10.49	- .56	-1.20	-1.32
COMPARISON HOSPITALS	10.78	10.73	.05	10.10	10.68	- .59	- .68	- .64
DX GROUP 13: ACUTE MYOCARDIAL INFARCTION								
CR HOSPITALS	19.35	17.84	1.51	17.38	17.86	- .47	-1.97	-1.98
COMPARISON HOSPITALS	18.97	18.15	.82	17.86	18.31	- .45	-1.11	-1.27
DX GROUP 14: DIABETES								
CR HOSPITALS	11.11	10.91	.20	10.73	11.01	- .27	- .38	- .47
COMPARISON HOSPITALS	11.27	11.30	-.03	10.35	11.48	-1.13	- .92	-1.10
DX GROUP 15: MALIGNANT NEOPLASM OF BREAST								
CR HOSPITALS	12.10	11.82	.28	11.52	12.20	- .68	- .58	- .96
COMPARISON HOSPITALS	12.03	11.39	.14	11.79	12.18	- .39	- .24	- .53
DX GROUP 16: DELIVERY								
CR HOSPITALS	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.
COMPARISON HOSPITALS	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.

N.O. Not Observed

TABLE 5.6 (Cont'd)

CHANGE IN ALOS BY DIAGNOSIS GROUP
FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DIAGNOSTIC GROUP AND HOSPITAL GROUP	PRE-REVIEW			POST REVIEW			DIFFERENCE	
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS)POST (ALOS)PRE	(ALOS-ELOS)POST -(ALOS-ELOS)PRE
DX GROUP 17: HYPERTROPHY TONSILS & ADENOIDS								
CR HOSPITALS	3.58	3.84	- .27	4.43	4.81	- .39	+ .85	- .12
COMPARISON HOSPITALS	5.33	5.80	- .47	3.40	5.20	- 1.80	-1.93	-1.33
DX GROUP 18: FRACTURE OF FEMURE								
CR HOSPITALS	23.29	21.94	1.35	23.19	21.89	1.30	- .10	- .05
COMPARISON HOSPITALS	22.25	22.69	- .44	21.77	22.99	-1.22	- .48	- .78
DX GROUP 19: CATARACT								
CR HOSPITALS	5.97	5.13	.84	4.92	5.12	- .20	-1.05	-1.04
COMPARISON HOSPITALS	6.38	5.26	1.12	5.10	5.23	- .12	-1.28	-1.24
DX GROUP 20: NEUROSES								
CR HOSPITALS	11.84	12.16	- .32	12.51	12.38	.13	+1.11	+ .45
COMPARISON HOSPITALS	13.24	12.18	1.07	13.08	12.12	.95	- .16	- .12
DX GROUP 21: APPENDICITIS								
CR HOSPITALS	14.22	13.44	.78	12.77	13.70	- .93	-1.45	-1.71
COMPARISON HOSPITALS	14.14	13.48	.66	12.02	13.57	-1.54	-2.12	-2.20
DX GROUP 22: OTHER								
CR HOSPITALS	10.60	10.44	.16	10.03	10.61	- .58	- .57	- .74
COMPARISON HOSPITALS	10.26	10.76	- .49	10.02	10.93	- .91	- .24	- .42

When the changes in ALOS for the concurrent review hospitals are compared to the changes in ALOS for the comparison hospitals, eight diagnosis groups experienced greater decreases in ALOS for the review hospitals than for the non-review hospitals. When the ALOS-ELOS measure is considered, in only six of the twenty-two diagnosis groups did the concurrent review hospitals out perform the comparison hospitals in reducing ALOS. Table 5.7 summarizes the differences in ALOS and ALOS-ELOS pre-post period changes between concurrent review hospitals and comparison hospitals.

It is apparent that for the majority of diagnosis groups (14 out of 22), the concurrent review hospitals were not as or no more successful than the comparison hospitals in reducing the ALOS between the pre-review and post-review periods. The largest net reduction in ALOS for the Medicare patients occurred in three diagnosis groups: Acute Myocardial Infarction, Cerebrovascular Disease, and Chronic Ischemic Heart Disease with the concurrent review hospitals doing better in reducing ALOS than the comparison hospitals by at least one-half day. If the ALOS-ELOS measure is considered, diagnosis group #5 (Ulcer Stomach) with a .51 day difference between the hospital groups, is added to the list.

It should be noted that seven of the eight diagnosis groups in which the concurrent review hospitals reduced ALOS more than the comparison hospitals had an ALOS in the pre-review period for concurrent review hospitals that exceeded the ALOS for the comparison hospitals. Likewise, all six of the diagnosis groups that showed greater decreases in ALOS-ELOS for review than for non-review hospitals had high values for the ALOS-ELOS measure in the pre-review period. Conversely, 10 of the 13 diagnostic groups where the concurrent review hospitals did less well than the comparison hospitals had an ALOS for the concurrent review hospitals that was less than the comparison hospitals. This pattern would seem to suggest that the ALOS and ALOS-ELOS for

TABLE 5.7

Differences in ALOS and ALOS-ELOS Pre-Post Changes Between Concurrent Review and Comparison Hospitals: MEDICARE

Dx #	Diagnosis Group	ALOS			ALOS-ELOS		
		Concurrent Review	Comparison	Difference (Comparison-CR)	Concurrent Review	Comparison	Difference (Comparison-CR)
1	Hypertension	- .26	- .79	- .53	- .58	- .93	- .35
2	Pneumonia	- .24	- .21	+ .03	- .35	- .49	- .14
3	Congestive Heart Failure Pulmonary Edema	- .07	- .49	- .42	- .20	- .68	- .48
4	Urinary Tract Infection	- .14	- .67	- .53	- .32	- .65	- .33
5	Ulcer Stomach, Duodenal Peptic, Gastrojejunal	- .75	- .44	+ .31	-1.69	-1.18	+ .51
6	Cholecystitis/Choletithiasis	- .47	- .23	+ .24	- .54	- .57	- .03
7	Inguinal Hernia without Obstruction	- .59	- .78	- .19	- .68	- .80	- .12
8	Hyperplasia Prostate	- .53	- .99	- .46	- .62	- .92	- .30
9	Intervertebral Disc, Displacement	+ .22	- .41	- .63	- .29	- .58	- .29
10	Complications & Adverse Reactions	+ .58	- .72	-1.30	+ .19	- .89	-1.08
11	Cerebrovascular Disease	- .72	- .07	+ .65	- .47	+ .40	+ .87
12	Chronic Ischemic Heart Disease	-1.20	- .68	+ .52	-1.32	- .64	+ .68
13	Acute Myocardial Infarction	-1.97	-1.11	+ .86	-1.98	-1.27	+ .71
14	Diabetes w/ & w/o Acidosis	- .38	- .92	- .54	- .47	-1.10	- .63
15	Malignant Neoplasm of Breast	- .58	- .24	+ .34	- .96	- .53	+ .43
16	Delivery w/ & w/o Complications	N.O.	N.O.	--	N.O.	N.O.	--
17	Hypertrophy Toncils and Adenoids	+ .85	-1.93	-2.78	- .12	-1.33	-1.21

TABLE 5.7, continued

Dx #	Diagnosis Group	ALOS			ALOS-ELOS		
		Concurrent Review	Comparison	Difference (Comparison-CR)	Concurrent Review	Comparison	Difference (Comparison-CR)
18	Fracture of Femur	- .10	- .48	- .38	- .05	- .78	- .73
19	Cataract	-1.05	-1.28	- .23	-1.04	-1.24	0 .20
20	Neuroses	+1.11	- .16	-1.27	+ .45	- .12	- .57
21	Appendicitis	-1.45	-2.12	- .67	-1.71	-2.20	- .49
22	Other	- .57	- .24	+ .33	- .74	- .42	+ .32

concurrent review and comparison hospitals were simply converging for many of the specific diagnosis groups during the time period included in the evaluation. To some extent, it would appear that ALOS for the concurrent review hospitals were "catching up" to the already lower lengths of stay in the comparison hospitals for the eight diagnosis groups.

Regression analysis was used to test the statistical significance of the relationships between changes in the length of stay, the presence or absence of review, the time period, and the interaction of hospital type and time for the twenty-two diagnostic categories. The results of this analysis are presented in Table 5.8. Inspection of the t values and their associated probabilities for the cross product term of STYPE·TIME shows that the change in length of stay for the concurrent review hospitals versus the comparison hospitals was not significant at the $p<.10$ level for any of the diagnosis groups. Therefore, it may be concluded that none of the declines in ALOS from the pre-review to the post-review period for the concurrent review hospitals were significantly different from the declines observed for the comparison hospitals and that there is not sufficient evidence to reject the diagnosis group specific null hypothesis that changes in ALOS are equal for concurrent review and comparison hospitals. Although the changes in ALOS for all diagnosis groups combined were statistically significant for the concurrent review hospitals versus the comparison hospitals, this finding cannot be supported for any of the specific diagnosis groups.

The coefficients of the TIME term in the regressions, however, do show that eight diagnosis groups had statistically significant decreases in ALOS for the Medicare patients in the concurrent review hospitals. These diagnosis groups are listed below:

TABLE 5.8

ALOS Regression Analysis by Diagnosis Group: Medicare

Dependent Variable: ALOS Form: $ALOS = \beta_0 + \beta_1\ STYPE + \beta_2\ TIME + \beta_3\ (STYPE \cdot TIME) + \beta_4\ ELOS + \epsilon$

Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-Value	P	Estimate	t-Value	P		
1. Hypertension	-0.6212	-1.89	.0589	-0.3459	-0.09	.4911	729	724
2. Pneumonia	-0.3441	-1.08	.2824	0.0827	0.15	.8795	764	759
3. Congestive Heart Failure	-0.2021	-0.62	.5375	-0.4978	-0.89	.3719	763	758
4. Urinary Tract Infection	-0.3186	-0.83	.4079	-0.3252	-0.56	.5766	656	651
5. Ulcer Stomach	-1.6210	-4.29	.0001	0.4955	0.83	.4044	723	718
6. Cholecystitis/Choletithiasis	-0.5779	-2.05	.0406	-0.0136	-0.03	.9769	751	746
7. Inguinal Hernia	-0.6858	-3.10	.0020	-0.1107	-0.30	.7677	713	708
8. Hyperplasia Prostate	-0.6079	-2.37	.0182	-0.3265	-0.77	.4424	691	686
9. Disc Displacement	-0.3541	-0.52	.6017	-0.2435	-0.22	.8241	475	470
10. Complications & Adverse Reactions	-.2847	0.76	.4488	-1.1351	-1.85	.0652	681	676
11. Cerebrovascular Disease	-0.5215	-1.73	.0835	0.8131	1.68	.0942	783	778
12. Chronic Ischemic Heart Disease	-1.3290	-5.23	.0001	0.6865	1.67	.0945	785	780
13. Acute Myocardial Infarction	-2.0068	-5.83	.0001	0.6949	1.26	.2091	720	715
14. Diabetes	-0.4858	-1.42	.1562	-0.6082	-1.12	.2647	742	737

TABLE 5.8

ALOS Regression Analysis by Diagnosis Group: Medicare
Continued

Dependent Variable: ALOS	Form: $ALOS = \beta_0 + \beta_1\ STYPE + \beta_2\ TIME + \beta_3\ (STYPE \cdot TIME) + \beta_4\ ELOS + \epsilon$							
Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-Value	P	Estimate	t-Value	P		
15. Malignant Neoplasm of Breast	-0.8916	-1.90	.0580	0.4135	0.54	.5907	570	565
16. Delivery	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	--	--
17. Hypertrophy Tonsils & Adenoids	-0.0465	-0.03	.9747	-1.3320	-0.51	.6156	27	22
18. Fracture of Femur	-0.0804	-0.11	.9145	-0.6465	-0.56	.5730	643	638
19. Cataract	-1.0463	-6.58	.0001	-0.2060	-0.70	.4832	570	565
20. Neuroses	0.4861	0.68	.4991	-0.6136	-0.53	.5929	515	510
21. Appendicitis	-1.6345	-1.62	.1069	-0.5904	-0.33	.7388	271	266
22. Other	-0.7511	-4.89	.0001	0.3263	1.33	.1824	810	805

Dx #	Diagnosis Group	Significance Level for ALOS Decrease in Concurrent Review Hospitals
5.	Ulcer Stomach	.0001
6.	Cholecystitis/Choletithiasis	.0406
7.	Inguinal Hernia	.0020
8.	Hyperplasia Prostate	.0182
12.	Chronic Ischemic Heart Disease	.0001
13.	Acute Myocardial Infarction	.0001
19.	Cataract	.0001
22.	Other	.0001

Essentially the same results were obtained using ALOS-ELOS as the dependent variable in the diagnosis group specific anlaysis.

Given the results of the analysis for all diagnosis groups combined and for the individual groups, it may be concluded that the PSRO activity had an overall net effect in reducing hospital length of stay for the concurrent review versus the comparison hospitals. However, although the decrease in length of stay in the concurrent review hospitals was significant for eight of the twenty-two diagnosis groups, a statistically significant effect could not be detected for any of the diagnosis groups when the concurrent review hospitals and comparison hospitals were compared.

5.2.4 Relationship of ALOS and Selected Hospital Characteristic Variables

Based on the literature of the determinants of length of stay and the sampling strata used in the development of the original data base, additional variables were selected for further analysis to investigate whether or not our understanding of the relationship between ALOS and hospital study type and time could be improved by controlling for additional hospital specific and/or county characteristics. The variables selected for this analysis include:

- Short-Term Beds in the Hospital
- Teaching Status of the Hospital
- Short-Term Beds per 1000 County Population aged 65 and over
- M.D.'s per 1000 County Population
- Extended Care Beds per 1000 County Population
- Occupancy Rate of the Hospital

Each of the continuous independent variables were examined in a previous study to identify breaking points for grouping hospitals for the displays shown in Tables 5.9A through 5.9F.

TABLE 5.9A

CHANGE IN AVERAGE LENGTH OF STAY
BY HOSPITAL (BED) SIZE -- MEDICARE

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.R. HOSPITALS NUMBER OF BEDS:								
6-49	8.08746	9.1633	-1.07583	7.67003	8.97972	-1.30969	-0.4174	-0.2339
50-99	8.86716	9.39508	-.527924	7.77316	9.26218	-1.48903	-1.0940	-0.9611
100-199	9.68676	10.0941	-.407323	9.40835	10.3403	-0.93193	-0.2784	-0.5246
200-299	10.3165	10.2122	0.104262	9.60438	10.3771	-.772697	-0.7121	-0.8770
300-499	11.3652	11.1119	0.253347	11.0652	11.2558	-.190675	-0.3000	-0.4440
500+	12.6206	11.092	1.52858	11.7576	11.444	0.313568	-0.8630	-1.2150
COMPARISON HOSPITALS NUMBER OF BEDS:								
6-49	9.70723	9.71908	-.011853	9.53661	9.96069	-.424076	-0.1706	-0.4122
50-99	9.86407	10.2811	-.417018	9.95047	10.3905	-.440012	0.0864	-0.0230
100-199	9.96371	11.2489	-1.28517	9.58819	11.2829	-1.69467	-0.3755	-0.4095
200-299	9.81561	10.7609	-.945262	9.38728	10.935	-1.54772	-0.4283	-0.6025
300-499	11.0693	11.2278	-.158504	10.7081	11.2995	-0.59141	-0.3612	-0.4329
500+	12.1592	11.0988	1.06032	11.4567	11.4088	.0479346	-0.7024	-1.0124

TABLE 5.9B

CHANGE IN AVERAGE LENGTH OF STAY
BY HOSPITAL TEACHING STATUS: MEDICARE

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.B. HOSPITALS TEACHING STATUS:								
NON-TCH	9.85721	10.1054	-.248153	9.39593	10.2708	-0.87491	-0.46129	-0.62676
TEACHNG	11.9177	11.0747	0.843085	11.2248	11.2738	-0.049	-0.69291	-0.89209
COMPARISON HOSPITALS TEACHING STATUS:								
NON-TCH	10.3942	10.7157	-.321481	10.1452	10.8174	-.672175	-0.24899	-0.35069
TEACHNG	11.478	11.6306	-.152615	10.7958	11.8287	-1.03297	-0.68219	-0.88035

TABLE 5.9C

CHANGE IN AVERAGE LENGTH OF STAY
BY COUNTY SHORT-TERM BED DENSITY (PER 1000 POPULATION): MEDICARE

	PRE-REVIEW			POST-REVIEW			(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS		
C.B. HOSPITALS NONFEDERAL SHORT-TERM BEDS/1000 POP.:								
0-3.4	8.81504	9.59113	-.776087	8.63931	9.86364	-1.22433	-0.17574	-0.44824
3.5-4.7	10.2663	10.1399	0.126422	9.80475	10.1787	-.373935	-0.46157	-0.50036
4.8-5.9	12.0298	11.4054	0.624363	11.2545	11.6005	-.345959	-0.77525	-0.97032
6.0+	10.7499	10.3093	0.440636	10.2054	10.567	-.361574	-0.54450	-0.80221
COMPARISON HOSPITALS NONFEDERAL SHORT-TERM BEDS/1000 POP.:								
0-3.4	9.27862	10.3645	-1.08591	9.03208	10.4423	-1.41022	-0.24654	-0.32430
3.5-4.7	10.9261	10.2223	0.703736	10.7259	10.4899	0.236011	-0.20016	-0.46773
4.8-5.9	10.5009	11.3352	-.834234	10.1108	11.3636	-1.25278	-0.39013	-0.41854
6.0+	11.1368	11.3901	-.253363	10.6799	11.6096	-.929675	-0.45683	-0.67631

TABLE 5.9D

CHANGE IN AVERAGE LENGTH OF STAY
BY COUNTY PHYSICIAN DENSITY (PER 1000 POPULATION): MEDICARE

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.R. HOSPITALS NONFEDERAL PHYSICIANS/1000 POP.:								
0-0.9	10.2474	10.6423	-.394935	9.84949	10.7113	-0.86182	-0.39789	-0.4669
1-1.4	10.8686	10.4329	0.435752	10.2149	10.6063	-.391355	-0.65371	-0.8271
1.5-1.9	11.3417	11.1491	0.192614	10.5586	11.3836	-.824954	-0.78311	-1.0176
2.0+	10.6175	10.1131	0.504354	10.2181	10.3174	-.099295	-0.39932	-0.6036
COMPARISON HOSPITALS NONFEDERAL PHYSICIANS/1000 POP.:								
0-0.9	10.1797	10.8856	-.705845	9.93545	10.9791	-1.04366	-0.24428	-0.3378
1-1.4	10.5093	10.4947	.0146135	10.2122	10.7453	-0.53302	-0.29706	-0.5476
1.5-1.9	11.4367	11.5865	-.149785	10.5667	11.5476	-.980927	-0.87004	-0.8311
2.0+	11.1971	11.68	-0.48292	10.9329	11.7541	-.821242	-0.26422	-0.3383

TABLE 5.9E

CHANGE IN AVERAGE LENGTH OF STAY
BY COUNTY E.C. BED DENSITY (PER 1000 POPULATION 65+): MEDICARE

	PRE-REVIEW			POST-REVIEW				
	ALCS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.R. HOSPITALS E.C. BEDS/1000 AGED 65+:								
NONE	10.5383	10.4491	.0891922	10.0517	10.6202	-0.56847	-0.4866	-0.6577
0.1-1.4	11.8276	10.8776	0.950038	11.1993	11.0839	0.115389	-0.6283	-0.8346
1.5-2.4	11.0243	10.8546	0.169652	10.2685	10.9357	-.667231	-0.7558	-0.8369
2.5+	10.6018	10.243	0.358814	9.96787	10.524	-.556111	-0.6339	-0.9149
COMPARISON HOSPITALS E.C. BEDS/1000 AGED 65+:								
NONE	10.8218	10.943	-.121167	10.3614	11.0262	-.664784	-0.4604	-0.5436
0.1-1.4	13.76	13.006	0.753999	12.216	12.7724	-.556367	-1.5440	-1.3104
1.5-2.4	9.04184	9.57802	-.536182	9.18524	9.70849	-.523252	0.1434	0.0129
2.5+	10.1753	11.0553	-.880021	10.1101	11.4532	-1.34319	-0.0652	-0.4632

TABLE 5.9F

CHANGE IN AVERAGE LENGTH OF STAY
BY HOSPITAL OCCUPANCY RATE -- MEDICARE

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.R. HOSPITALS OCCUPANCY RATE:								
0-59%	8.35834	8.80427	-0.44593	7.63668	8.80284	-1.16616	-0.7217	-0.7202
60-69%	9.96506	10.1701	-.205079	9.23344	10.2486	-1.01512	-0.7316	-0.8100
70-79%	10.5	10.1463	0.353727	10.0287	10.4024	-.373679	-0.4713	-0.7274
80-89%	12.0471	11.4977	0.549383	11.4873	11.6819	-.194535	-0.5597	-0.7439
COMPARISON HOSPITALS OCCUPANCY RATE:								
0-59%	9.79632	10.5355	-.739155	9.65943	10.5476	-.888215	-0.1369	-0.1491
60-69%	9.86082	11.0237	-1.16284	9.56555	11.1629	-1.59736	-0.2953	-0.4345
70-79%	10.1881	11.0481	-.859951	10.0087	11.1448	-1.13608	-0.1794	-0.2761
80-89%	11.405	10.8066	0.598441	10.8497	11.0654	-.215786	-0.5554	-0.8142
90%+	13.1954	11.8736	1.32187	11.8385	11.9196	-.081106	-1.3570	-1.4030

Separate regression analyses were performed for each of the hospital characteristic variables in Tables 5.9A-F and for Delegation Status in order to test the significance of these independent variables in explaining the relationship between ALOS (adjusted for ELOS), hospital study type (concurrent review versus comparison), and time (pre-review versus post-review periods). The simple regression model discussed in the previous section was modified by introducing the independent variable and appropriate interaction terms. The regression model for each independent variable, X, took the following form:

$$\text{ALOS} = \beta_0 + \beta_1 X + \beta_2\ \text{STYPE} + \beta_3\ \text{TIME} + \beta_4\ (X \cdot \text{STYPE}) + \beta_5\ (X \cdot \text{TIME}) + \beta_6\ (\text{STYPE} \cdot \text{TIME}) + \beta_7\ (X \cdot \text{STYPE} \cdot \text{TIME}) + \beta_8\ \text{ELOS} + \sum_{i=9}^{13} \beta_i z_i + \varepsilon$$

where the z_i are the other 5 independent variables

A complete discussion of the regression model is contained in the methodology chapter of this report. Before describing the results of the analysis, the reader is reminded that data for these hospital variables were available only for the pre period. Changes in these variables over time could therefore not be included in the analysis. The results of the analysis are shown in Tables 5.10A - 5.10F.

It can be seen from Table 5.10A that large (≥200 bed) concurrent review hospitals, large comparison hospitals, and small concurrent review hospitals all experienced significant reductions, post-pre, in ALOS (adjusted for ELOS). The reduction in ALOS experienced by small comparison hospitals was on the margin of statistical significance. Examination of the $\hat{\beta}_6 + \hat{\beta}_7$ and the $\hat{\beta}_6$ terms shows that for both big and small hospitals those hospitals with concurrent review experienced greater reductions in ALOS than comparison hospitals of similar size. However, the $\hat{\beta}_6 + \hat{\beta}_7$ term was only marginally significant and

Table 5.10A

Medicare ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Short Term Beds (in hospital)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 13382

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 46	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 91	$\tilde{CR}$ - CR
X: Short Term Beds (in hospital) Large: 200+ n = 69	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.62306$ P>F = 0.0001 n = 24	$\hat{\beta}_3+\hat{\beta}_5 = -0.82061$ P>F = 0.0001 n = 45	$\hat{\beta}_6+\hat{\beta}_7 = 0.19755$ P>F = 0.0548
$\tilde{X}$: Short Term Beds (in hospital) Small: 6-199 n = 68	$\hat{\beta}_3+\hat{\beta}_6 = -0.28300$ P>F = 0.0657 n = 22	$\hat{\beta}_3 = -0.58574$ P>F = 0.0001 n = 46	$\hat{\beta}_6 = 0.30274$ P>F = 0.1057
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = -0.34006$ P>F = 0.0499	$\hat{\beta}_5 = -0.23487$ P>F = 0.0581	$\hat{\beta}_7 = -0.10519$ P>F = 0.6220

the $\hat{\beta}_6$ term was not at all significant at the .05 level. In other words, for neither hospital size group was the difference in reduction in ALOS between PSRO concurrent review hospitals and comparison hospitals significant at the .05 level. Turning to the $\hat{\beta}_7$ term we find no significant difference between the differential performance of the PSRO concurrent review versus the comparison group for big hospitals, and the corresponding differential for small hospitals.

While not the primary purpose of the analysis, it is also interesting to examine the $\hat{\beta}_5 + \hat{\beta}_7$ and the $\hat{\beta}_5$ terms. The fact that both of these terms are less than zero implies that for both concurrent review and comparison hospitals greater reductions in ALOS were experienced in big hospitals than in small hospitals. This finding, however, was only marginally significant at the .05 level.

Turning next to the analysis of hospital teaching status (Table 5.10B), we find that concurrent review teaching, concurrent review non-teaching, comparison teaching and comparison non-teaching hospitals all experienced significant secular reductions in ALOS. The fact that the $\hat{\beta}_5 + \hat{\beta}_7$ and $\hat{\beta}_5$ terms are significantly less than zero implies that for both concurrent review and comparison hospitals greater reductions in ALOS were experienced in teaching hospitals than in non-teaching hospitals. It can be seen from the $\hat{\beta}_7 + \hat{\beta}_6$ term that there was no significant difference, for teaching hospitals, between the decrease in ALOS experienced by the concurrent review hospitals and the decrease experienced by the comparison hospitals. The $\hat{\beta}_6$ term, on the other hand, is statistically significant, implying that for non-teaching hospitals concurrent review yielded a significantly greater reduction in ALOS than the comparison. However, the lack of statistical significance for $\hat{\beta}_7$ implies that the differential impact of concurrent review in teaching versus non-teaching hospitals was not significant.

Results for the analysis of short-term hospital beds per 1000 county

Table 5.10B

Medicare ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i z_i+\varepsilon$

INDEPENDENT VARIABLE X = Teaching Status

z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 13382

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 46	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 91	$\tilde{CR}$ - CR
X: Teaching Status Teaching n = 37	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.90369$ P>F = 0.0001 n = 9	$\hat{\beta}_3+\hat{\beta}_5 = -0.92548$ P>F = 0.0001 n = 28	$\hat{\beta}_6+\hat{\beta}_7 = 0.02088$ P>F = 0.8897
$\tilde{X}$: Teaching Status Non-teaching n = 100	$\hat{\beta}_3+\hat{\beta}_6 = -0.37209$ P>F = 0.0001 n = 37	$\hat{\beta}_3 = -0.62621$ P>F = 0.0001 n = 63	$\hat{\beta}_6 = 0.25412$ P>F = 0.0247
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = -0.53160$ P>F = 0.0005	$\hat{\beta}_5 = -0.29837$ P>F = 0.0064	$\hat{\beta}_7 = 0.23324$ P>F = 0.2155

population and shown in Table 5.10C. It can be seen that concurrent review and comparison hospitals in counties with both high (≥ 4.75 beds/1000) bed-population ratios and low bed-population ratios all experienced significant secular reductions in ALOS. For hospitals located in counties with high bed-population ratios we find a significantly greater reduction in ALOS for concurrent review hospitals than for the comparison hospitals ($\hat{\beta}_6 + \hat{\beta}_7$). In addition, we find that concurrent review hospitals located in counties with high bed-population ratios experienced significantly greater reductions in ALOS than concurrent review hospitals located in counties with low bed-population ratios ($\hat{\beta}_5$). Again, the $\hat{\beta}_7$ term is not statistically significant, implying no significant differential PSRO impact in high bed-population ratio counties versus low bed-population ratio counties.

Results for the analysis of M.D.'s per 1000 county population are shown in Table 5.10D. We find that signficant reductions in ALOS were experienced in both concurrent review and comparison hospitals located in counties with high (≥ 1.5 M.D.'s/1000) and low M.D. population ratios. However, while concurrent review hospitals performed better than comparison hospitals regardless of the M.D. population ratio, neither of these differences ($\hat{\beta}_6 + \hat{\beta}_7$ and $\hat{\beta}_6$) are statistically significant.

The results of the analysis of extended care beds per 1000 county population over age 65 are displayed in Table 5.10E and were described in detail as an example in the methodology section of this report. The ECF beds population ratio was the only independent variable examined that yielded a statistically significant $\hat{\beta}_7$ term. To summarize this major finding, it was observed that concurrent review hospitals located in counties with high (≥ 1.5 beds/1000 people over age 65) ECF bed population ratios showed significantly greater reductions in ALOS than comparison hospitals located in counties with high

Table 5.10C

Medicare ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Short Term NonFederal Beds/1000 Pop. (in county)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 13382

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 46	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 91	$\tilde{CR}$ - CR
X: Short Term NonFederal Beds/1000 Pop. (in county) High: 4.750+ n = 73	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.60488$ P>F = 0.0001 n = 27	$\hat{\beta}_3+\hat{\beta}_5 = -0.91570$ P>F = 0.0001 n = 46	$\hat{\beta}_6+\hat{\beta}_7 = 0.31083$ P>F = 0.0049
$\tilde{X}$: Short Term NonFederal Beds/1000 Pop. (in county) Low: 0-4.749 n = 64	$\hat{\beta}_3+\hat{\beta}_6 = -0.45479$ P>F = 0.0002 n = 19	$\hat{\beta}_3 = -0.48243$ P>F = 0.0001 n = 45	$\hat{\beta}_6 = 0.02764$ P>F = 0.8549
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = -0.15008$ P>F = 0.3148	$\hat{\beta}_5 = -0.43327$ P>F = 0.0001	$\hat{\beta}_7 = 0.28319$ P>F = 0.1299

Table 5.10D

Medicare ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Active NonFederal Physicians/1000 Pop. (in county)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 13382

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 46	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 91	$\tilde{CR}$ - CR
X: Active NonFederal Physicians/1000 Pop. (in county) High: 1.5+ n = 52	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.63855$ P>F = 0.0001 n = 13	$\hat{\beta}_3+\hat{\beta}_5 = -0.81164$ P>F = 0.0001 n = 39	$\hat{\beta}_6+\hat{\beta}_7 = 0.17309$ P>F = 0.2189
$\tilde{X}$: Active NonFederal Physicians/1000 Pop. (in county) Low: 0-1.49 n = 85	$\hat{\beta}_3+\hat{\beta}_6 = -0.49363$ P>F = 0.0001 n = 33	$\hat{\beta}_3 = -0.71063$ P>F = 0.0001 n = 52	$\hat{\beta}_6 = 0.21699$ P>F = 0.0669
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = -0.14492$ P>F = -.3262	$\hat{\beta}_5 = = -0.10101$ P>F = 0.3565	$\hat{\beta}_7 = -0.04390$ P>F = 0.8114

Table 5.10E

Medicare ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Extended Care Beds/1000 Pop. 65+ (in county)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 13382

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 46	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 91	$\tilde{CR}$ - CR
X: Extended Care Beds/1000 Pop. 65+ (in county) High: 1.5+ n = 42	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.30394$ P>F = 0.0156 n = 12	$\hat{\beta}_3+\hat{\beta}_5 = -0.88258$ P>F = 0.0001 n = 30	$\hat{\beta}_6+\hat{\beta}_7 = 0.57864$ P>F = 0.0002
$\tilde{X}$: Extended Care Beds/1000 Pop. 65+ (in county) Low: 0-1.49 n = 95	$\hat{\beta}_3+\hat{\beta}_6 = -0.67390$ P>F = 0.0001 n = 34	$\hat{\beta}_3 = -0.69157$ P>F = 0.0001 n = 61	$\hat{\beta}_6 = 0.01767$ P>F = 0.8722
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = 0.36996$ P>F = 0.0152	$\hat{\beta}_5 = -0.19101$ P>F = 0.0987	$\hat{\beta}_7 = 0.56097$ P>F = 0.0034

ECF bed population ratios, while no difference between concurrent review and comparison hospitals was observed in counties with low ECF bed population ratios. Furthermore, the significant $\hat{\beta}_7$ term implies that this differential PSRO impact was statistically significant.

Results of the analysis of the occupancy rate variable are displayed in Table 5.10F. Significant reductions in ALOS were experienced by both high ($\geq$ 70%) and low occupancy rate hospitals in both the concurrent review and the comparison groups. Concurrent review hospitals, however, experienced greater reductions in ALOS for both high and low occupancy hospitals than were experienced by the comparison hospitals.

To summarize the major findings of the analysis of hospital and catchment area independent variables, it was found that:

- For both concurrent review and comparison hospitals significantly greater reductions in ALOS were experienced in teaching than in non-teaching hospitals. When looking only at non-teaching hospitals, concurrent review as significantly more effective in reducing ALOS than the comparison group
- For hospitals located in areas with high short-term bed population ratios, the concurrent review hospitals performed significantly better than the comparison group, while in areas with low bed population ratios no differences were observed between concurrent review and comparison groups
- For hospitals located in counties with high ratios of ECF beds to population over age 65 concurrent review hospitals experienced significantly greater reductions in ALOS than comparison hospitals. No differences were observed between the ALOS reductions experienced by concurrent review and comparison hospitals in areas with low ECF bed/population ratios.

The findings relating to ECF bed population ratios were the most significant. PSRO concurrent review activities can be most effective in reducing ALOS for Medicare patients in areas which have an adequate supply of extended care beds.

Table 5.10F

Medicare ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Occupancy Rate (in hospital)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 13382

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 46	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 91	$\tilde{CR}$ - CR
X: Occupancy Rate (in hospital) High: 70%+ n = 80	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.58477$ P>F = 0.0001 n = 29	$\hat{\beta}_3+\hat{\beta}_5 = -0.75598$ P>F = 0.0001 n = 51	$\hat{\beta}_6+\hat{\beta}_7 = 0.17120$ P>F = 0.0927
$\tilde{X}$: Occupancy Rate (in hospital) Low: 0% - 69.9% n = 57	$\hat{\beta}_3+\hat{\beta}_6 = -0.40110$ P>F = 0.0198 n = 17	$\hat{\beta}_3 = -0.77156$ P>F = 0.0001 n = 40	$\hat{\beta}_6 = 0.37046$ P>F = 0.0646
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = -0.18367$ P>F = 0.3310	$\hat{\beta}_5 = 0.01558$ P>F = 0.8978	$\hat{\beta}_7 = -0.19926$ P>F = 0.3752

5.2.5 Relationship of ALOS and Delegation Status

In addition to testing the relationship between ALOS, concurrent review, and the selected hospital characteristic variables, the impact of concurrent review delegation status was also estimated. In essence the problem posed was to determine whether or not there were differences in the efficacy of concurrent review as a function of concurrent review characteristics, rather than hospital characteristics. Because the most obvious feature of concurrent review activities are related to the delegation status of review for a particular hospital, it was singled out for further study. While experts in the PSRO field have offered a number of arguments concerning the relative merits of having PSRO's perform the review functions (non-delegated) versus having the review activities delegated to individual hospitals, there is little or no objective evidence to indicate the superiority of one mode over the other. Thus, it is of interest to apply the methodology developed here to see if any differential can be detected.

The basic regression model was again used as the vehicle of analysis. However, in this instance only the concurrent review hospitals were included in the study sample since the problem was to differentiate between the two states of delegation. Under these conditions, the model becomes:

$$ALOS = \beta_0 + \beta_1\ DSTAT + \beta_2\ TIME + \beta_3\ D{\cdot}T + \beta_4\ ELOS + \varepsilon$$

where ALOS, ELOS, TIME, and ε are defined as before, with the addition of:

DSTAT = Delegation Status

0 = Non-Delegated (ND)

1 = Delegated (D)

D·T = Cross Product of Delegations Status and Time

As before, we can also specify ALOS-ELOS as the dependent variable; and, if Y is taken as the symbol for either adjusted ALOS or ALOS-ELOS, we have the following interpretation for the regression parameters:

$$\beta_1 = \overline{\Delta Y} \text{ (D - ND | PRE)}$$

$$\beta_2 = \overline{\Delta Y} \text{ (Post-Pre | ND)}$$

$$\beta_3 = \left[\overline{\Delta Y} \text{ (Post-Pre | D)}\right] - \left[\overline{\Delta Y} \text{ (Post-Pre | ND)}\right]$$

where D indicates a delegated review hospital and ND indicates a non-delegated hospital. In other words, β_1 measures the difference in utilization between delegated and non-delegated in the pre period, β_2 measures the secular change in utilization for non-delegated hospitals, and β_3 measures the difference in the secular change in utilization between delegated and non-delegated hospitals.

The results of the GLS multiple regression estimates are presented in Table 5.10G for adjusted ALOS and ALOS-ELOS. As has occurred throughout the study, the estimated regression parameters using the two alternative dependent variables are near-identical. From the $\hat{\beta}_1$ results we conclude that initial adjusted ALOS's were significantly greater (P=.0001) in non-delegated compared with delegated concurrent review hospitals. From the $\hat{\beta}_2$ results we find, as would be expected based on other results presented herein, that adjusted ALOS decreased between the pre and post periods for non-delegated hospitals. Finally, and most importantly, we infer from the $\hat{\beta}_3$ results that there was a small (and only marginally statistically significant) difference between the secular change in adjusted ALOS between the delegated and non-delegated hospitals. The small positive sign for $\hat{\beta}_3$ (+0.207) indicates that adjusted ALOS decreased by 0.2 days more in non-delegated hospitals relative to the delegated group. In quantitative terms, the secular decrease for the non-delegated hospitals was estimated as $\hat{\beta}_2$ = -0.91 days, whereas the secular decrease for the delegated hospitals was $(\hat{\beta}_2 + \hat{\beta}_3)$ = (-0.91 + .21) = -.70 days, with the difference in the decrease (delegated - nondelegated) equal to +.21 days. While the difference between delegated and non-delegated was not significant at the conventional P=.05 level, it was nearly so (P = .059).

Table 5.10G

Analysis Results of the Relationship Between Average Length of Stay, Expected Length of Stay, Delegation Status and Time: MEDICARE

Dependent Variable: ALOS FORM: $ALOS + \beta_0 + \beta_1 DSTAT + \beta_2 TIME + \beta_3 (DSTAT \cdot TIME) + \beta_4 ELOS + \varepsilon$

NUMBER OF OBSERVATIONS = 8865
DEGREES OF FREEDOM = 8870

PARAMETER		ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STANDARD ERROR OF ESTIMATE
β_0	CONSTANT	.05201600	.45	.6536	.1158881
β_1	DSTAT	-.52251643	-6.62	.0001	.07894226
β_2	TIME	-.91495975	-10.32	.0001	.08867686
β_3	D X T	.20688634	1.89	.0591	.10960102
β_4	ELOS	1.05096608	108.47	.0001	.00968914

Dependent Variable: ALOS-ELOS FORM: $ALOS = \beta_0 + \beta_1 DSTAT + \beta_2 TIME + \beta_3 (STYPE \cdot TIME) + \varepsilon$

NUMBER OF OBSERVATIONS = 8866
DEGREES OF FREEDOM = 8870

PARAMETER		ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STANDARD ERROR OF ESTIMATE
β_0	CONSTANT	.56394046	8.94	.0001	.06305958
β_1	DSTAT	-.48286331	-6.14	.0001	.07869991
β_2	TIME	-.90349114	-10.18	.0001	.08878545
β_3	D X T	.20412922	1.86	.0630	.10976819

In view of the policy-related relevance of the above results, it is desirable to test the impact of delegation status using a somewhat different model. In the above model the sample included only concurrent review hospitals and the relative performance of the delegated versus non-delegated were compared. However, it is perhaps more appropriate to examine the relative performance of delegated vs non-delegated concurrent review hospitals using as a reference the comparison hospitals. Two separate samples were therefore used in the estimation: (1) the comparison hospitals plus the delegated concurrent review hospitals; and (2) the comparison hospitals plus the non-delegated concurrent review hospitals. Two separate regression equations were then estimated using the basic model adjusted for ELOS and the hospital characteristic variables:

$$ALOS = \beta_0 + \beta_1\ STYPE + \beta_2\ TIME + \beta_3\ S{\cdot}T + \beta_4\ ELOS + \sum_{i=5}^{10} \beta_i Z_i + \varepsilon$$

The estimation results are reported in Table 5.10H.

The results are consistent with the previous model in that adjusted ALOS decreased more for the non-delegated relative to the delegated concurrent review hospitals. Moreover, it is seen that while the delegated group lowered adjusted ALOS more than the comparison group [-0.55 - (-0.70) = +0.15], that difference was not statistically significant (P = 0.14). On the other hand, the non-delegated group significantly (P=0.008) out-performed the comparison group [-0.55 -(-0.88) = + 0.32]. Thus, if all of the concurrent review hospitals had been non-delegated, their comparative advantage in lowering adjusted ALOS for Medicare patients would have been about 0.3 days, rather than the 0.2 days which has been observed for the combined group throughout this section. This piece of evidence gives support to the previous conclusion regarding the superior performance of the non-delegated versus the delegated concurrent review hospitals in lowering utilization rates.

Table 5.10H

Medicare ALOS Regression Results for Delegated, Nondelegated,
and All PSRO Concurrent Review Hospitals vs. Comparison Hospitals

FORM: $ALOS = \beta_0+\beta_1 \cdot STYPE+\beta_2 \cdot TIME+\beta_3(STYPE \cdot TIME)+\sum_{i=4}^{9}\beta_i Z_i+\beta_{10}ELOS+\varepsilon$

Z_i = 6 independent binary variables (Teaching Status, Bedsize, etc.)

n = number of hospitals in each category

HOSPITAL GROUPS COMPARED	COMPARISON HOSPITALS: $\tilde{CR}$	PSRO CONCURRENT REVIEW HOSPITALS: CR	$\tilde{CR}$ - CR
Delegated PSRO CR vs. Comparison Hospitals n = 103 Number of Observ.= 10065	$\hat{\beta}_2+\hat{\beta}_3$ = -0.55617 P>F = 0.0001 n = 46	$\hat{\beta}_2$ = -0.70303 P>F = 0.0001 n = 57	$\hat{\beta}_3$ = 0.14686 P>F = 0.1429
Nondelegated PSRO CR vs. Comparions Hospitals n = 80 Number of Observ.= 7829	$\hat{\beta}_2+\hat{\beta}_3$ = -0.54934 P>F = 0.0001 n = 46	$\hat{\beta}_2$ = -0.86565 P>F = 0.0001 n = 34	$\hat{\beta}_3$ = 0.31631 P>F = 0.0085

5.2.6 ALOS within Geographic Census Region

To test the impact of PSRO concurrent review within geographic census region, our sample of hospitals was divided into four hospital location groups in the following manner:

Census region codes

1 = North East (ME, NH, VT, MA, RI, CT, NY, NJ, PA)

2 = North Central (OH, IND, IL, MI, WI, MN, IA, MO, ND, SD, Nebraska, Kansas)

3 = South (Del, MD, DC, VA, WV, NC, SC, GA, FL, KY, TN, Alabama, MISS, ARK, LA, OK, TX)

4= West (MT, Idaho, WY, Colorado, NM, AZ, Utah, Nev, WA, CA, Alaska, Hawaii)

We then ran four separate ALOS regression estimates for each of the regions, using the basic model discussed earlier, adjusting for ELOS and six independent dichotomized hospital characteristics (teaching status, occupancy rate, bedsize, beds/1000 population, etc.). The results of the regression estimates for each region and for all regions combined are presented in Table 5.10I. Although partitioning our sample by region necessarily reduced the number of observations, and hence the statistical significance of the $\hat{\beta}_3$ results, some general trends are nonetheless evident.

Adjusted ALOS decreased significantly for both hospital groups in the north central, southern and western regions. The amount of decrease was greatest in the north central region ($\hat{\beta}_2+\hat{\beta}_3$ = -0.77 days for the comparison and $\hat{\beta}_2$ = -0.97 days for the PSRO concurrent review hospitals), followed by the southern region ($\hat{\beta}_2+\hat{\beta}_3$ = -0.61; $\hat{\beta}_2$ = -0.72), followed by the western region ($\hat{\beta}_2+\hat{\beta}_3$ = -0.47; $\hat{\beta}_2$ = -0.52). The small number of hospitals in the north east clouds the results for the comparison hospitals in that region (P = 0.31); however, the PSRO concurrent review hospitals experienced a significant (P = 0.02) reduction of 0.74 days in the north east.

Table 5.101

Medicare ALOS Regression Results by Geographic Census Region

FORM: $ALOS = \beta_0+\beta_1 \cdot STYPE+\beta_2 \cdot TIME+\beta_3(STYPE \cdot TIME)+\sum_{i=4}^{9} \beta_i z_i+\beta_{10} ELOS+\varepsilon$

z_i = 6 independent binary variables (Teaching Status, Bedsize, etc.)

n = number of hospitals in each category

Geographic Census Region	COMPARISON HOSPITALS: $\tilde{CR}$	PSRO CONCURRENT REVIEW HOSPITALS: CR	$\tilde{CR}$ - CR
Region 1: Northeast n = 12 Number of Observ.= 1267	$\hat{\beta}_2+\hat{\beta}_3$ = -0.25073 P>F = 0.3122 n = 7	$\hat{\beta}_2$ = -0.74426 P>F = 0.0205 n = 5	$\hat{\beta}_3$ = 0.49353 P>F = 0.2204
Region 2: North Central n = 51 Number of Observ.= 5212	$\hat{\beta}_2+\hat{\beta}_3$ = -0.77328 P>F = 0.0001 n = 15	$\hat{\beta}_2$ = -0.96761 P>F = 0.0001 n = 36	$\hat{\beta}_3$ = 0.19433 P>F = 0.1705
Region 3: South n = 34 Number of Observ.= 3289	$\hat{\beta}_2+\hat{\beta}_3$ = -0.60567 P>F = 0.0001 n = 18	$\hat{\beta}_2$ = -0.72064 P>F = 0.0001 n = 16	$\hat{\beta}_3$ = 0.11497 P>F = 0.4545
Region 4: West n = 40 Number of Observ.= 3614	$\hat{\beta}_2+\hat{\beta}_3$ = -0.47457 P>F = 0.0014 n = 6	$\hat{\beta}_2$ = -0.52028 P>F = 0.0001 n = 34	$\hat{\beta}_3$ = 0.04571 P>F = 0.7870
All U.S.A. (Total Regions 1-4) n = 137 Number of Observ.= 13382	$\hat{\beta}_2+\hat{\beta}_3$ = -0.55322 P>F = 0.0001 n = 46	$\hat{\beta}_2$ = -0.76025 P>F = 0.0001 n = 91	$\hat{\beta}_3$ = 0.20703 P>F = 0.0216

Scanning the $\hat{\beta}_3$ estimated values ($\hat{\beta}_3$ measures the relative change in ALOS over time between the comparison and PSRO concurrent review hospitals) by region, we see that in order of best to worst PSRO concurrent review performance relative to the comparison group the regions again are: region 1: north east ($\hat{\beta}_3 = 0.49$), region 2: north central ($\hat{\beta}_3 = 0.19$), region 3: south ($\hat{\beta}_3 = 0.11$) and region 4: west ($\hat{\beta}_3 = 0.05$). Furthermore, as the $\hat{\beta}_3$ values decrease from region 1 to region 4, the corresponding levels of statistical significance also tend to decrease (the slight exception being the shift from region 1 to region 2, but region 1 has only 12 hospitals), weakening successively the findings of positive $\hat{\beta}_3$ coefficients (superior PSRO concurrent review performance). As a reference level, the main results of our ALOS analysis for all 4 regions combined are shown on the bottom line of Table 5.10I.

These overall findings would tend to indicate that PSRO concurrent review was more effective in reducing ALOS in the north east and north central census regions than it was in the south and west. This result is not surprising in view of the traditionally longer lengths of stay in the north east and north central regions as compared with the south and west.[1] Furthermore, displaying the Medicare hospitals by region and PSRO concurrent review start quarter (Table 5.10J), we see that PSRO concurrent review hospitals tended generally to start review earlier in the south and west than in the north east and north central census regions. Hence, the relatively "poor performance" of the PSRO concurrent review hospitals in the south and west during our study period may be due in part to their having started review earlier; their lengths of stay may have already been pushed downward during the "pre-review" period as a result of warmup or other unknown utilization review programs that predated Title 18 binding PSRO review.

Table 5.10J

NUMBER OF MEDICARE HOSPITALS BY GEOGRAPHIC CENSUS REGION
STUDY TYPE & QUARTER OF PSRO CR START

TABLE OF REGIONAM BY QTRSTART

REGIONAM REGION NAME QTRSTART QUARTER PSRO CR BEGAN

FREQUENCY PERCENT ROW PCT COL PCT	A:4TH QTR 1974	B:2ND QTR 1975	C:3RD QTR 1975	D:4TH QTR 1975	X:NEVER STARTED	TOTAL
NORTH EAST	1	0	1	3	7	12
	0.73	0.00	0.73	2.19	5.11	8.76
	8.33	0.00	8.33	25.00	58.33	
	16.67	0.00	4.76	5.45	15.22	
NORTH CENT.	0	2	1	33	15	51
	0.00	1.46	0.73	24.09	10.95	37.23
	0.00	3.92	1.96	64.71	29.41	
	0.00	22.22	4.76	60.00	32.61	
SOUTH	0	0	5	11	18	34
	0.00	0.00	3.65	8.03	13.14	24.82
	0.00	0.00	14.71	32.35	52.94	
	0.00	0.00	23.81	20.00	39.13	
WEST	5	7	14	8	6	40
	3.65	5.11	10.22	5.84	4.38	29.20
	12.50	17.50	35.00	20.00	15.00	
	83.33	77.78	66.67	14.55	13.04	
TOTAL	6	9	21	55	46	137
	4.38	6.57	15.33	40.15	33.58	100.00

To complete the regression analysis, a correlation coefficient matrix was generated weighting each pre/post hospital-diagnosis-quarter observation by the number of patients therein. Continuous variables included in the correlation were ALOS, ELOS, hospital occupancy rate, number of short-term beds in the hospital, M.D.'s per 1000 county population, extended care beds per 1000 county population aged 65 and over, short-term beds per 1000 county population and geographic census region (1,...,4). Binary variables included were teaching status, study type, time (pre-post) and the cross product term STYPE•TIME. The matrix is presented in Table 5.10K. The output from the computer runs which generated each of the regression estimates discussed in this chapter can be obtained (at the cost of reproduction) from the Commission on Professional and Hospital Activities, 1968 Green Road, Ann Arbor, Michigan 48105. Attention: Project Development Department.

5.3 LENGTH OF STAY DISTRIBUTION ANALYSIS

The primary purpose of the analysis of the distribution of length of stay is to assess the effect of PSRO concurrent review activity on changing the distribution of Medicare patients in the hospital. This analysis is intended to augment the ALOS analysis in that the mean of the length of stay distribution may not change between periods or across hospital type; but the distribution in terms of percent short stays and percent long stays may change considerably with important policy implications for the PSRO concurrent review activity.

Table 5.10K

MEDICARE MATRIX --- WEIGHTED BY THE NUMBER OF PATIENTS IN EACH HOSPITAL-DIAGNOSIS-QUARTER(3 PRE & 3 POST) OBSERVATION

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 13382

	ALOS	ELOS	TEACHING	OCCPRATE	SHORTBED	MDSCKPOP	ECBEDSCK	BEDSCKPO	REGION	STYPE	TIME	S_T
ALOS	1.00000 0.0000	0.71912 0.0001	0.20132 0.0001	0.27536 0.0001	0.26425 0.0001	0.07643 0.0001	-0.07792 0.0001	0.07733 0.0001	-0.32493 0.0001	0.00332 0.7008	-0.06585 0.0001	-0.02117 0.0143
ELOS	0.71912 0.0001	1.00000 0.0000	0.16289 0.0001	0.21755 0.0001	0.16079 0.0001	0.06258 0.0001	-0.04924 0.0001	0.08286 0.0001	-0.48225 0.0001	0.07711 0.0001	0.03300 0.0001	0.06252 0.0001
TEACHING	0.20132 0.0001	0.16289 0.0001	1.00000 0.0000	0.31778 0.0001	0.61071 0.0001	0.47694 0.0001	-0.09169 0.0001	0.22177 0.0001	-0.18089 0.0001	-0.13718 0.0001	0.00449 0.6036	-0.07857 0.0001
OCCPRATE	0.27536 0.0001	0.21755 0.0001	0.31778 0.0001	1.00000 0.0000	0.39151 0.0001	0.10085 0.0001	0.06025 0.0001	0.14915 0.0001	-0.31028 0.0001	0.07684 0.0001	0.01011 0.2421	0.05456 0.0001
SHORTBED	0.26425 0.0001	0.16079 0.0001	0.61071 0.0001	0.39151 0.0001	1.00000 0.0000	0.45128 0.0001	-0.11620 0.0001	0.21337 0.0001	-0.19239 0.0001	0.05038 0.0001	0.00045 0.9587	0.04298 0.0001
MDSCKPOP	0.07643 0.0001	0.06258 0.0001	0.47694 0.0001	0.10085 0.0001	0.45128 0.0001	1.00000 0.0000	0.14253 0.0001	0.28894 0.0001	0.03134 0.0003	-0.04149 0.0001	-0.00161 0.8524	-0.02218 0.0103
ECBEDSCK	-0.07792 0.0001	-0.04924 0.0001	-0.09169 0.0001	0.06025 0.0001	-0.11620 0.0001	0.14253 0.0001	1.00000 0.0000	-0.04597 0.0001	0.15701 0.0001	-0.00357 0.6799	-0.00871 0.3138	-0.00934 0.2800
BEDSCKPO	0.07733 0.0001	0.08286 0.0001	0.22177 0.0001	0.14915 0.0001	0.21337 0.0001	0.28894 0.0001	-0.04597 0.0001	1.00000 0.0000	-0.08818 0.0001	0.12620 0.0001	-0.01512 0.0804	0.06459 0.0001
REGION	-0.32493 0.0001	-0.48225 0.0001	-0.18089 0.0001	-0.31028 0.0001	-0.19239 0.0001	0.03134 0.0003	0.15701 0.0001	-0.08818 0.0001	1.00000 0.0000	-0.10917 0.0001	-0.00323 0.7084	-0.07019 0.0001
STYPE	0.00332 0.7008	0.07711 0.0001	-0.13718 0.0001	0.07684 0.0001	0.05038 0.0001	-0.04149 0.0001	-0.00357 0.6799	0.12620 0.0001	-0.10917 0.0001	1.00000 0.0000	0.01146 0.1848	0.63749 0.0001
TIME	-0.06585 0.0001	0.03300 0.0001	0.00449 0.6036	0.01011 0.2421	0.00045 0.9587	-0.00161 0.8524	-0.00871 0.3138	-0.01512 0.0804	-0.00323 0.7084	0.01146 0.1848	1.00000 0.0000	0.47812 0.0001
S_T	-0.02117 0.0143	0.06252 0.0001	-0.07857 0.0001	0.05456 0.0001	0.04298 0.0001	-0.02218 0.0103	-0.00934 0.2800	0.06459 0.0001	-0.07019 0.0001	0.63749 0.0001	0.47812 0.0001	1.00000 0.0000

As in the ALOS analysis,the analysis of % short and % long stay patient-was performed for both all admissions and individually for the 22 diagnosis groups. The same evaluation design and regression approach used in the ALOS analysis was used to test the hypotheses related to % Short and % Long Stays.

The % Short and % Long Stay variables were developed through the use of the CPHA Length of Stay Study (LSS) program described in the methodology which was also used to generate the ELOS calculation. The definition of a Short Stay for the LSS program is any stay less than the fifth percentile for matched patients. A Long Stay is any stay greater than the seventy-fifth percentile for matched patients. The patient matching technique uses the same patient characteristics as ELOS.

Before the results of the statistical tests of the hypotheses are given, some basic characteristics of the trends in the % Short and % Long Stays for the concurrent review and comparison hospitals are described.

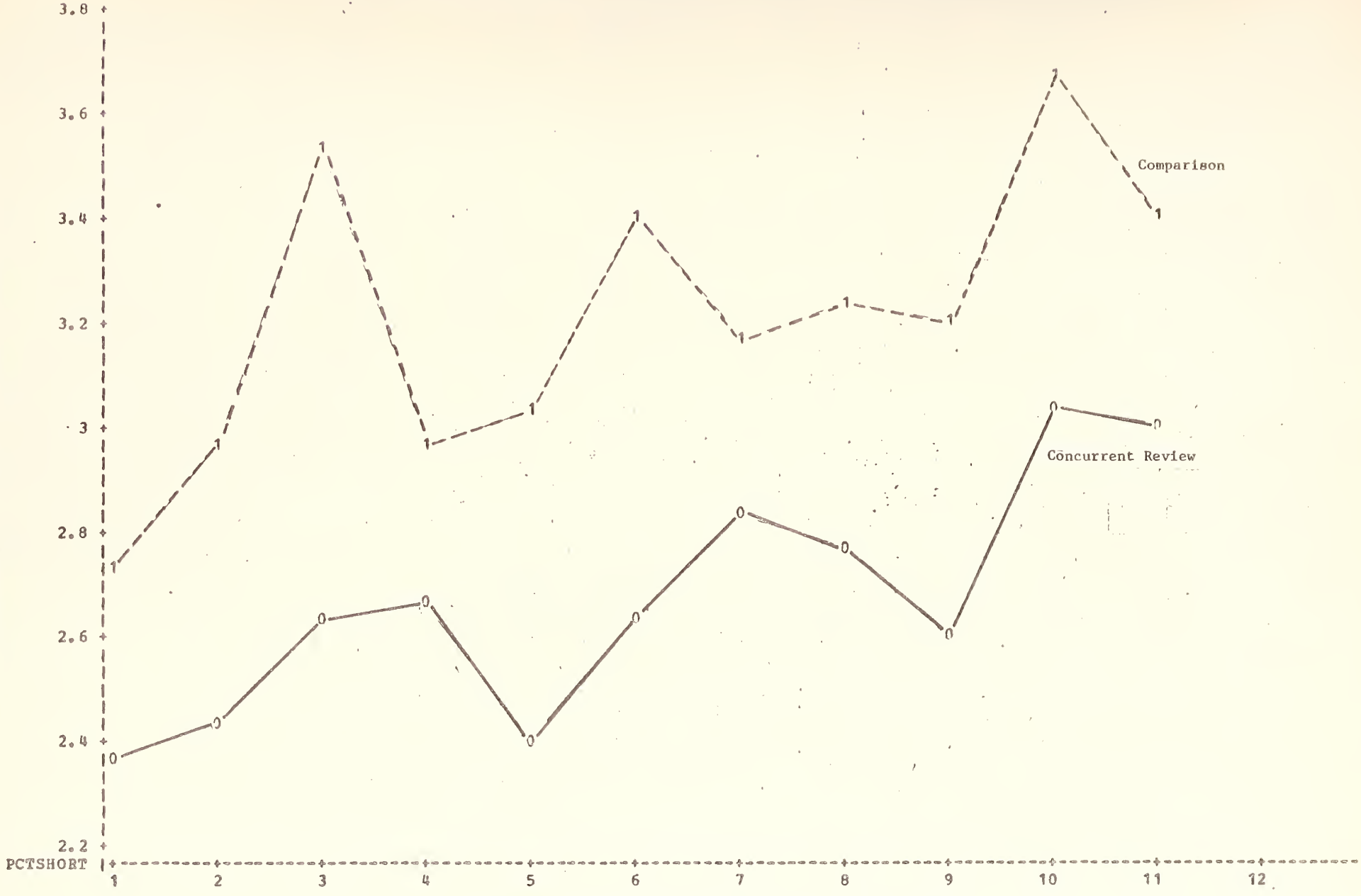
5.3.1 Trends in % Short and % Long Stays

The generally declining trend in the ALOS over the eleven-quarter time period is reflected in the trends of % Short Stays and % Long Stays. As shown in Figure 5.4, the % Short Stays have been increasing over time for both the concurrent review and comparison hospitals. The concurrent review hospitals have had a smaller % Short Stays than the comparison hospitals for the entire time period. Between the first quarter of 1974 and the third quarter of 1976, the % Short Stays went from 2.4% to 3.0% for the concurrent review hospitals and from 2.7% to 3.4% for the comparison hospitals--about the same relative amount of change.

The % Long Stays exhibited a steadily declining trend over the time period for both hospital groups. The change in % Long Stays over the time period was considerably more pronounced than the change in % Short Stays with the concurrent

PERCENT OF SHORT STAY PATIENTS (UNDER 5TH %-TILE) BY QUARTER
FOR STUDY (0) AND COMPARISON (1) HOSPITALS --- MEDICARE

PLOT OF QUARTER*PCTSHORT LEGEND: SYMBOL IS VALUE OF STYPE



review hospitals dropping from 25.7% to 19.8% and the comparison hospitals going from 24.1% Long Stays to 19.5% between the first quarter, 1974 and the third quarter of 1976. It is important to note that the % Long Stays in the concurrent review hospitals was higher than in the comparison hospitals for the entire time period indicating, perhaps, that there was more opportunity for reducing the % Long Stays in the concurrent hospitals.

Unlike the trends for % Short Stays for concurrent review and comparison hospitals which remained approximately equidistant between the beginning and end of the time period, the % Long Stays for the two hospital groups appeared to converge toward the end of the time period. Figure 5.5 shows the trends in % Long Stays for the concurrent review and comparison hospitals.

The analysis of the trend lines is given in Table 5.11. From the t-values and their associated probabilities it may be seen that there is no statistically significant difference between the slopes of the best fit lines for concurrent review and comparison hospitals for either % Short or % Long Stays.

TABLE 5.11

Test of Differences in Slopes of % Long Stay and % Short Stay Between Concurrent Review and Comparison Hospitals: Medicare

Dependent Variable	Number of Observations	Slope CR Hospitals	Slope Comparison Hospitals	Differences in Slope Comparison CR	t-value	P-value
% Short Stays	11	0.057	0.052	-0.005	-0.20	.85
% Long Stays	11	-0.530	-0.401	0.129	1.47	.16

Table 5.12 provides the % Short Stays and % Long Stays for concurrent review and comparison hospitals by quarters.

Figure 5.5

PERCENT OF LONG STAY PATIENTS (OVER 75TH %-TILE) BY QUARTER
FOR STUDY (0) AND COMPARISON (1) HOSPITALS --- MEDICARE

PLOT OF QUARTER*PCTLONG LEGEND: SYMBOL IS VALUE OF STYPE

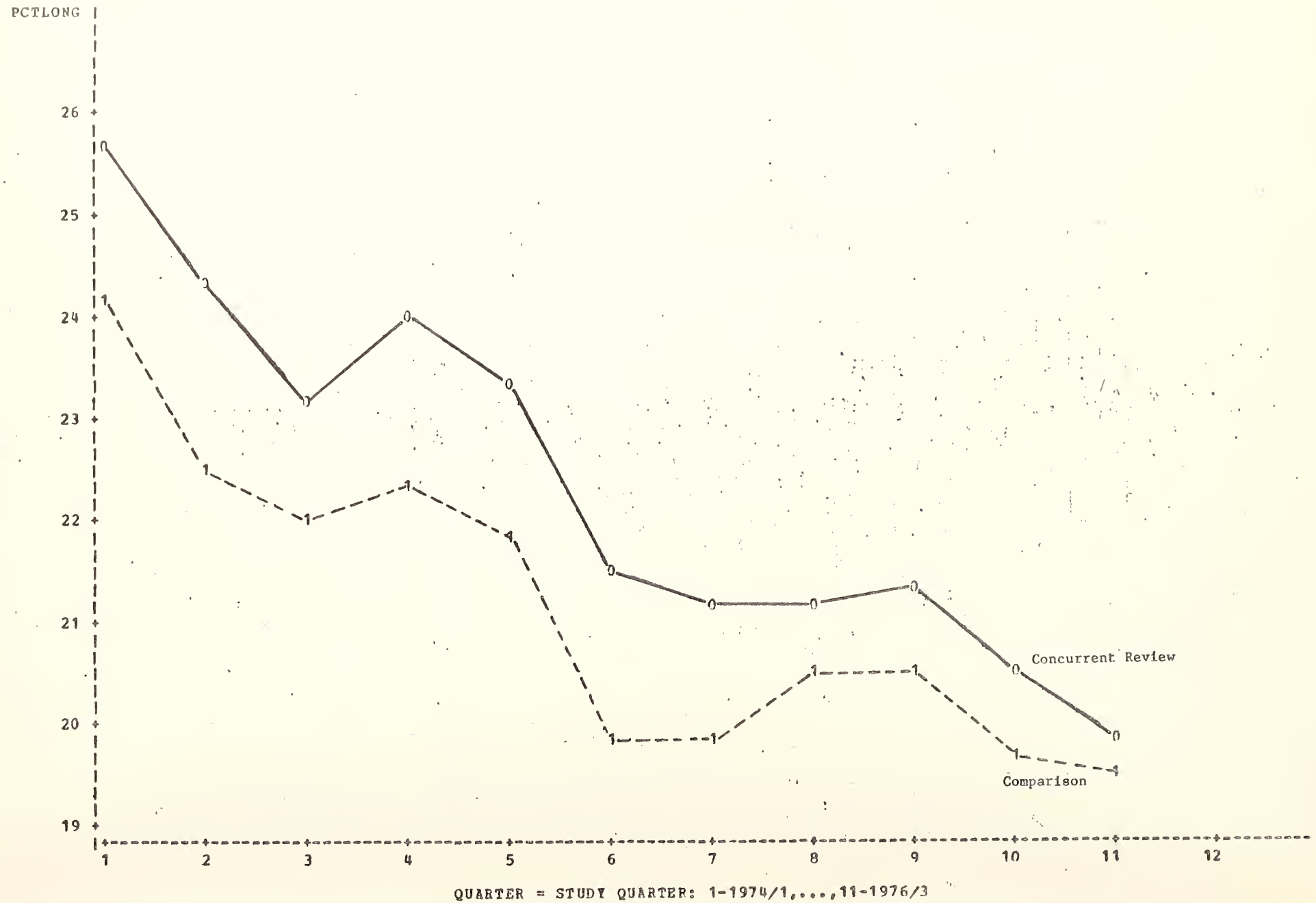


TABLE 5.12

% Short Stays and % Long Stays by Quarter for
Concurrent Review and Comparison Hospitals: Medicare

Hospital Group \ Quarter	1974				1975				1976		
	1	2	3	4	1	2	3	4	1	2	3
% Short Stays:											
Concurrent Review	2.4	2.4	2.6	2.7	2.4	2.6	2.8	2.8	2.6	3.0	3.0
Comparison	2.7	3.0	3.5	3.0	3.0	3.4	3.2	3.2	3.2	3.7	3.4
% Long Stays:											
Concurrent Review	25.7	24.3	23.2	24.1	23.4	21.5	21.1	21.2	21.4	20.4	19.8
Comparison	24.1	22.5	22.0	22.3	21.8	19.8	19.9	20.4	20.5	19.7	19.5

5.3.2 Pre-Post Analysis of % Short Stays and % Long Stays

When the changes in the % Short Stays and % Long Stays between the pre-review and post-review periods for concurrent review and comparison hospitals were examined, it was found that the % Short Stays increased in both hospital groups by almost the same amount. In addition, the increase in % Short Stays was very slight between the two periods (.4% for concurrent review and .3% for comparison hospitals).

The decrease in the % Long Stays, however, was more apparent with concurrent review hospitals experiencing a decrease of 3.8% in % Long Stays and the comparison hospitals reducing their % Long Stays by 2.9% between the pre-review and post-review periods. Table 5.13 presents the changes between pre and post periods for % Short Stays and % Long Stays by hospital group.

TABLE 5.13

Change in % Short Stays (LOS < 5th Percentile) and % Long Stays (LOS > 75th Percentile) for Concurrent Review and Comparison Hospitals: Medicare

Hospital Group \ Period	Pre-Review	Post-Review	Differences (Post-Pre)	(Post-Pre) Comparison -(Post-Pre) CR
% Short Stays				
Concurrent Review	2.5%	2.9%	.4%	-.1%
Comparison	3.1%	3.4%	.3%	
% Long Stays				
Concurrent Review	24.4%	20.6%	-3.8%	+.9%
Comparison	22.8%	19.9%	-2.9%	

Table 5.14 presents the number and percent of hospitals by direction of change in the % Short Stays and % Long Stays for the concurrent review and comparison hospitals. For % Short Stays, it may be seen that while 65.9% of the concurrent review hospitals experienced an increase in the % Short Stays, 69.6% of the comparison hospitals also experienced an increase. However, the interaction of the direction of pre-post change and hospital group is statistically insignificant ($X^2 = 0.183$, $P = 0.6691$).

Very little difference in the percent distribution of hospitals by hospital group and direction of change for % Long Stays is observed. Eighty percent of the concurrent review hospitals experienced a decrease in the % Long Stays while 78.3% of the comparison hospitals also had a drop in the % Long Stays. As with the % Short Stays, the slight difference in the proportion is not statistically significant ($X^2 = 0.072$, $P = 0.7883$).

The statistical significance of the changes in % Short Stays and % Long Stays as a function of hospital type, time, and the interaction effects of these two variables was tested using a linear regression model. The form of the model is identical to that used to test the ALOS and ALOS-ELOS dependent variables in

TABLE 5.14

Number and Percent of Hospitals by Direction of Change in % Short Stays and % Long Stays for Concurrent Review and Comparison Hospitals: Medicare

Hospital Group \ Direction of Change		(%Short Stays)Post-(%Short Stays)Pre			Total
		<0	=0	>0	
Concurrent Review	N	31	0	60	91
	%	34.1	0.0	65.9	100.0%
Comparison	N	14	0	32	46
	%	30.4	0.0	69.6	100.0%
TOTAL	N	45	0	92	137
	%	32.9	0.0	67.1	100.0%

Chi-Square = 0.183, P = 0.6691, D.F. = 1 (For 2x2 Table with 0 and >0 Categories combined)

Hospital Group \ Direction of Change		(%Long Stays)Post-(%Long Stays)Pre			Total
		<0	=0	>0	
Concurrent Review	N	73	1	17	91
	%	80.2	1.1	18.7	100.0%
Comparison	N	36	0	10	46
	%	78.3	0.0	21.7	100.0%
TOTAL	N	109	1	27	137
	%	79.6	.7	19.7	100.0%

Chi-Square = 0.072, P = 0.7883, D.F. = 1 (For 2x2 Table with 0 and >0 Categories combined)

the previous section. The results of the regression analysis are given in Table 5.15.

Turning first to the % Short Stays, we conclude that % Short Stays was, on the average, higher by .61% in the comparison hospitals than in the concurrent review hospitals in the pre-review period (coefficient $\hat{\beta}_1$). Confirming the previous findings given in Table 5.13, the $\hat{\beta}_2$ coefficient of the TIME term

TABLE 5.15

Analysis Results of the Relationship Between
% Short Stay, % Long Stay, Hospital Review Type, and Time

Dependent Variable: % Short Stays Form: % Short Stays = $\beta_0+\beta_1$STYPE$+\beta_2$TIME$+\beta_3$(STYPE·TIME) + ϵ

Number of Observations = 13,382
Degrees of Freedom = 13,378

PARAMETER	ESTIMATE	T for HO: PARAMETER=0	PR > |T|	Std Error of ESTIMATE
β_0 Constant	2.47932997	34.74	0.0001	0.07137013
β_1 STYPE	0.60758705	5.09	0.0001	0.11938383
β_2 TIME	0.40423543	3.99	0.0001	0.10126877
β_3 SxT	-0.06501941	-0.40	0.6911	0.16359851

Dependent Variable: % Long Stays Form: % Long Stays = $\beta_0+\beta_1$STYPE$+\beta_2$TIME$+\beta_3$(STYPE·TIME)

Number of Observations = 13,382
Degrees of Freedom = 13,378

PARAMETER	ESTIMATE	T for HO: PARAMETER=0	PR > |T|	Std Error of ESTIMATE
β_0 Constant	24.38684018	125.07	0.0001	0.19499259
β_1 STYPE	-1.56446280	-4.80	0.0001	0.32617233
β_2 TIME	-3.88002266	-14.02	0.0001	0.27667961
β_3 SxT	.91449953	2.05	0.0408	0.44697265

indicates that % Short Stays increased by .40% on the average between the pre-review and post-review periods for concurrent review hospitals. The increase in the % Short Stays for the comparison hospitals was .33% ($\hat{\beta}_2+\hat{\beta}_3$ = .40-.07 = .33). Therefore, while the % Short Stays increased for the concurrent review hospitals, it also increased, although somewhat less, in the comparison hospitals. When the levels of statistical significance given in Table 5.15 are examined, we find that the coefficients of the STYPE term ($\hat{\beta}_1$) and the TIME term ($\hat{\beta}_2$) were statistically significant at the P<.05 level. Specifically, the .40% increase in the % Short Stays between the pre-review and post-review periods for the concurrent review hospitals was significant with P=.0001. The slight added impact of .07% for the concurrent review compared with the comparison hospitals was not statistically significant, however.

Therefore, with regard to the % Short Stays, there is not sufficient evidence to reject the null hypothesis that changes in the % Short Stays between pre-review and post-review periods are equal for concurrent review and comparison hospitals.

The analysis of the % Long Stays is somewhat more interesting. Inspection of the regression coefficients shows that between the pre-review and post-review periods, the concurrent review hospitals, on the average, experienced a decline of 3.88% in the % Long Stays ($\hat{\beta}_2$=-3.88). The decline was significant at the P = .0001 level. The $\hat{\beta}_1$ coefficient indicates that the % Long Stays in the pre-review period were, on the average, higher in the concurrent review hospitals by 1.56% than in the comparison hospitals. Again, this difference is also significant at the P = .0001 level. From the interaction term ($\hat{\beta}_3$ = .91), it may be concluded that the difference of almost one percent between the % long stay changes in the concurrent review and the comparison hospitals was statistically significant at $p < .05$. The PSRO concurrent review activity

was apparently more effective by a small margin in reducing the % long stays in the concurrent review hospitals then were the comparison hospitals. Therefore, there appears to be sufficient evidence to reject the null hypothesis that changes in the % long stays between pre-review and post-review periods are equal for concurrent review and comparison hospitals. However, the magnitude of the difference, less than one percentage point, may not be enough of a change to be interesting or significant from a policy standpoint.

5.3.3 Diagnostic Specific Pre-Review, Post-Review Analysis of % Short and % Long Stays

The twenty-two diagnosis groups were analyzed to determine whether or not significant changes could be identified in % short stays or % long stays between pre-review and post-review periods for any specific diagnosis groups.

The results of the analysis are presented in Tables 5.16 and 5.17 for the % short stay variable. From the first table, it may be seen that 15 diagnosis groups increased the % short stays between the two time periods for the concurrent review hospitals. However, in only seven groups was the increase in % short stays greater than one percent. The largest changes in % short stays for the concurrent review hospitals were in diagnosis groups #5, Ulcer, with an increase of 2.3%; and #9, Disc Displacement, with an increase of 2.4%. One diagnosis group, #20 Neuroses, substantially decreased the % short stays in the concurrent review hospitals, dropping from 5.6% in the pre-review period to 1.5% in the post-review period.

When the differences between the concurrent review and comparison hospitals are examined, eleven of the twenty-two diagnosis groups had increases in short stays for the concurrent review hospitals that exceeded the increases in the comparison hospitals. Again, the disc displacement diagnosis group had the greatest net difference of 2.7% followed by Chronic Ischemic Heart

TABLE 5.16

CHANGE IN % SHORT STAYS BY DIAGNOSTIC GROUP
CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DIAGNOSIS GROUP AND HOSPITAL GROUP	PRE-REVIEW	POST-REVIEW	DIFFERENCES	
			(POST-PRE)	(POST-PRE) -(POST-PRE)
DX 1: HYPERTENSION				
CR HOSPITALS	1.9	3.6	1.7	
COMPARISON HOSPITALS	2.2	3.1	.9	- .8
DX 2: PNEUMONIA				
CR HOSPITALS	2.1	2.3	.1	
COMPARISON HOSPITALS	2.4	3.6	1.2	1.1
DX 3: HEART FAILURE				
CR HOSPITALS	3.5	2.7	- .8	
COMPARISON HOSPITALS	3.5	3.7	.2	1.0
DX 4: URINARY TRACT INFECTION				
CR HOSPITALS	3.0	3.1	.1	
COMPARISON HOSPITALS	3.2	5.6	2.4	2.3
DX 5: ULCER				
CR HOSPITALS	2.0	4.3	2.3	
COMPARISON HOSPITALS	3.6	6.1	2.5	.2
DX 6: CHOLECYSTITIS/ CHOLETITHIASIS				
CR HOSPITALS	2.2	3.2	1.0	
COMPARISON HOSPITALS	2.3	2.7	.4	- .6
DX 7: INGUINAL HERNIA				
CR HOSPITALS	1.2	2.3	1.1	
COMPARISON HOSPITALS	2.0	1.8	- .2	-1.3
DX 8: HYPERPLASIS PROSTATE				
CR HOSPITALS	3.3	3.4	.1	
COMPARISON HOSPITALS	4.4	3.8	- .6	- .7
DX 9: DISC DISPLACEMENT				
CR HOSPITALS	1.8	4.2	2.4	
COMPARISON HOSPITALS	5.1	4.8	- .3	-2.7
DX 10: COMPLICATIONS & ADVERSE REACTIONS				
CR HOSPITALS	1.8	2.1	.3	
COMPARISON HOSPITALS	2.6	2.6	.0	- .3

TABLE 5.16 (Cont'd.)

CHANGE IN % SHORT STAYS BY DIAGNOSTIC GROUP
CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DIAGNOSIS GROUP AND HOSPITAL GROUP	PRE-REVIEW	POST-REVIEW	DIFFERENCES	
			(POST-PRE)	(POST-PRE) -(POST-PRE)
DX 11: CEREBROVASCULAR DISEASE				
CR HOSPITALS	2.9	3.0	.1	
COMPARISON HOSPITALS	3.2	3.4	.2	.1
DX 12: CHRONIC ISCHEMIS HEART DISEASE				
CR HOSPITALS	2.0	3.2	1.2	
COMPARISON HOSPITALS	3.4	3.0	- .4	-1.6
DX 13: ACUTE MYOCARDIAL INFARCTION				
CR HOSPITALS	3.2	4.7	1.5	
COMPARISON HOSPITALS	4.6	5.1	.5	-1.0
DX 14: DIABETES				
CR HOSPITALS	1.8	2.4	.6	
COMPARISON HOSPITALS	4.7	4.8	.1	- .5
DX 15: MALIGNANT NEOPLASM OF BREAST				
CR HOSPITALS	2.9	3.7	.8	
COMPARISON HOSPITALS	4.4	3.9	- .5	-1.3
DX 16: DELIVERY				
CR HOSPITALS	N.O.	N.O.	-	-
COMPARISON HOSPITALS				
DX 17: HYPERTROPHY TONSILS AND ADENOIDS				
CR HOSPITALS	N.O.	N.O.	-	-
COMPARISON HOSPITALS				
DX 18: FRACTURE OF FEMUR				
CR HOSPITALS	4.9	3.1	-1.8	
COMPARISON HOSPITALS	5.1	5.2	.1	1.9
DX 19: CONTARACT				
CR HOSPITALS	.2	.7	.5	
COMPARISON HOSPITALS	.1	.5	.4	-.1

TABLE 5.16 (Cont'd.)

CHANGE IN % SHORT STAYS BY DIAGNOSTIC GROUP
CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DIAGNOSIS GROUP AND HOSPITAL GROUP	PRE-REVIEW	POST-REVIEW	DIFFERENCES	
			(POST-PRE)	(POST-PRE) -(POST-PRE)
DX 20: NEUROSES				
CR HOSPITALS	5.6	1.5	-4.1	
COMPARISON HOSPITALS	2.9	3.3	.4	4.5
DX 21: APPENDICITIS				
CR HOSPITALS	1.7	0	-1.7	
COMPARISON HOSPITALS	3.6	4.8	1.2	2.9
DX 22: OTHER				
CR HOSPITALS	2.6	3.0	- .4	
COMPARISON HOSPITALS	3.1	3.4	.3	.7

TABLE 5.17

% SHORT STAYS REGRESSION ANALYSIS BY DIAGNOSIS GROUP: MEDICARE

DEPENDENT VARIABLE: % SHORT STAYS FORM: % SHORT STAYS = $\beta_0 + \beta_1$ STYPE + β_2 TIME + β_3 (STYPE TIME) + ϵ

DIAGNOSIS GROUP	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	ESTIMATE	t-VALUE	P	ESTIMATE	t-VALUE	P		
1 - HYPERTENSION	1.7674	2.43	.0155	- .8270	- .74	.4592	729	725
2 - PNEUMONIA	.0939	.18	.8609	1.0831	1.19	.2359	764	760
3 - HEART FAILURE	- .8379	-1.51	.1317	.9817	1.04	.2990	763	759
4 - URINARY TRACT INFECTION	.1327	.13	.8941	2.2772	1.51	.1313	656	652
5 - ULCER	2.3773	2.86	.0043	.1083	.08	.9348	723	719
6 - CHOLECYSTITIS/CHOLETITHIASIS	1.0204	1.72	.0866	-.5621	-.57	.5713	751	747
7 - INGUINAL HERNIA	1.0733	2.00	.0462	-1.3053	-1.43	.1525	713	709
8 - HYPERPLASIA PROSTATE	.1116	.17	.8659	- .7270	- .67	.5060	691	687
9 - DISC DISPLACEMENT	2.419	1.93	.0545	-2.6727	-1.32	.1888	475	471
10 - COMPLICATIONS & ADVERSE REACTIONS	.3572	.53	.5974	- .2829	0.25	.7988	681	677
11 - CEREBROVASCULAR DISEASE	.0548	.10	.9167	.0817	.10	.9230	783	779
12 - CHRONIC ISCHEMIC HEART DISEASE	1.1528	2.55	.0110	-1.541	-2.11	.0352	785	781
13 - ACUTE MYOCARDIAL INFARCTION	1.4578	1.88	.0608	- .8808	.71	.4796	720	716

TABLE 5.17 (Cont'd.)

% SHORT STAYS REGRESSION ANALYSIS BY DIAGNOSIS GROUP: MEDICARE

DEPENDENT VARIABLE: % SHORT STAYS FORM: % SHORT STAYS = $\beta_0 + \beta_1$ STYPE + β_2 TIME + β_3 (STYPE TIME) + ϵ

DIAGNOSIS GROUP	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	ESTIMATE	t-VALUE	P	ESTIMATE	t-VALUE	P		
14 - DIABETES	.6734	.83	.4085	- .5246	- .40	.6859	742	738
15 - MALIGNANT NEOPLASM OF BREAST	.8409	.83	.4044	-1.2848	- .78	.4382	570	566
16 - DELIVERY	N.O.	N.O.			N.O.		-	-
17 - HYPERTROPHY TONSILS AND ADENOIDS	N.O.	N.O.			N.O.		-	-
18 - FRACTURE OF FEMUR	1.8822	-1.83	.0670	2.0216	1.29	.1985	643	639
19 - CATARACT	.4904	3.45	.0006	-0.1312	-0.50	.6172	570	566
20 - NEUROSES	-4.1550	-2.90	.0039	4.5202	1.98	.0484	515	511
21 - APPENDICITIS	-1.7989	-1.22	.2241	3.0835	1.19	.2341	271	267
22 - OTHER	.3345	1.68	.0931	.0368	.12	.9076	810	806

N.O. = Not Observed

Disease with a net difference of 1.69 short stays. Inspection of the diagnosis specific regression results for % short stays given in Table 5.17 provides additional explanation of the findings in Table 5.16. Of the 15 diagnosis groups that increased % short stays for the concurrent review hospitals, only five were found to be statistically significant at $P < .05$. These diagnosis groups are: #1. Hypertension; #5. Ulcer; #7. Inguinal Hernia; #12. Chronic Ischemic Heart Disease; and #19. Cataract. The decrease in % short stays observed for Neuroses in concurrent review hospitals is also found statistically significant. When the performance of the comparison hospitals in increasing short stays by diagnosis group are taken into account via the interaction term in the regression equation ($\hat{\beta}_3$), changes in % short stays are seen for only one diagnosis group. Chronic Ischemic Heart Disease remains statistically significant at $P < .05$. Given the statistical significance by diagnosis group, it would appear that the null hypothesis (changes for specific diagnosis groups in the % short stays between pre-review and post-review periods are equal for concurrent review and comparison hospitals) may be rejected for the Chronic Ischemic Heart Disease diagnosis group. The null hypothesis may also be rejected for Neuroses ($P = .0484$). However, the effect on short stays is in the opposite direction, i.e., comparison hospitals showed greater increases in short stays for this diagnosis group than concurrent review hospitals.

The results of the analysis of % long stays for medicare patients by diagnosis group are given in Tables 5.18 and 5.19. Eighteen of the diagnosis groups experienced decreases in the % long stays for the concurrent review hospitals, whereas 20 of the groups for the comparison hospitals declined between the pre-review and post-review periods. Only in seven diagnosis groups, however, did the concurrent review hospitals appear to be more

TABLE 5.18

CHANGE IN % LONG STAYS BY DIAGNOSTIC GROUP FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

DIAGNOSTIC GROUP AND HOSPITAL GROUP	PRE-REVIEW	POST-REVIEW	DIFFERENCES (POST-PRE)	(POST-PRE) -(POST-PRE)
DX 1: HYPERTENSION				
CR HOSPITALS	23.7	20.0	-3.7	-1.4
COMPARISON HOSPITALS	25.1	20.0	-5.1	
DX 2: PNEUMONIA				
CR HOSPITALS	22.4	20.7	-1.7	-1.5
COMPARISON HOSPITALS	23.6	20.4	-3.2	
DX 3: HEART FAILURE				
CR HOSPITALS	23.1	21.9	-1.2	1.0
COMPARISON HOSPITALS	22.5	22.3	- .2	
DX 4: URINARY TRACT INFECTION				
CR HOSPITALS	22.0	21.2	- .8	- .4
COMPARISON HOSPITALS	21.4	20.2	-1.2	
DX 5: ULCER				
CR HOSPITALS	27.9	21.3	-6.6	3.5
COMPARISON HOSPITALS	21.9	18.8	-3.1	
DX 6: CHOLECYSTITIS/ CHOLETITHIASIS				
CR HOSPITALS	25.0	22.1	-2.9	.7
COMPARISON HOSPITALS	23.1	20.9	-2.2	
DX 7: INGUINAL HERNIA				
CR HOSPITALS	22.1	17.9	-4.2	-1.8
COMPARISON HOSPITALS	23.7	17.7	-6.0	
DX 8: HYPERPLASIA PROSTATE				
CR HOSPITALS	25.2	23.1	-2.1	-4.6
COMPARISON HOSPITALS	27.0	20.3	-6.7	
DX 9: DISC DISPLACEMENT				
CR HOSPITALS	25.5	28.6	3.1	-10.8
COMPARISON HOSPITALS	25.6	17.9	-7.7	
DX 10: COMPLICATIONS & ADVERSE REACTIONS				
CR HOSPITALS	20.5	19.8	- .7	-3.8
COMPARISON HOSPITALS	19.6	16.5	-3.1	
DX 11: CEREBROVASCULAR DISEASE				
CR HOSPITALS	21.1	18.8	-2.3	3.0
COMPARISON HOSPITALS	20.9	21.6	.7	

TABLE 5.18
Continued

DIAGNOSTIC GROUP AND HOSPITAL GROUP	PRE-REVIEW	POST-REVIEW	DIFFERENCES (POST-PRE)	(POST-PRE) -(POST-PRE)
DX 12: CHRONIC HEART DISEASE				
CR HOSPITALS	25.7	19.7	-6.0	3.2
COMPARISON HOSPITALS	23.1	20.3	-2.8	
DX 13: ACUTE MYOCARDIAL INFARCTION				
CR HOSPITALS	28.7	19.8	-8.9	1.1
COMPARISON HOSPITALS	28.2	20.4	-7.8	
DX 14: DIABETES				
CR HOSPITALS	26.1	22.8	-3.3	-1.6
COMPARISON HOSPITALS	25.7	20.8	-4.9	
DX 15: MALIGNANT NEOPLASM OF BREAST				
CR HOSPITALS	23.5	20.7	-2.8	-2.5
COMPARISON HOSPITALS	25.3	20.0	-5.3	
DX 16: DELIVERY				
CR HOSPITALS	N.O.	N.O.	---	---
COMPARISON HOSPITALS				
DX 17: HYPERTROPHY TONSILS/ADENOIDS				
CR HOSPITALS	N.O.	N.O.	---	---
COMPARISON HOSPITALS				
DX 18: FRACTURE FEMUR				
CR HOSPITALS	29.3	27.9	-1.4	-3.2
COMPARISON HOSPITALS	23.9	19.3	-4.6	
DX 19: CATARACT				
CR HOSPITALS	29.0	17.3	-11.7	-1.3
COMPARISON HOSPITALS	32.1	19.1	-13.0	
DX 20: NEUROSES				
CR HOSPITALS	23.4	25.1	1.7	-1.9
COMPARISON HOSPITALS	27.1	26.9	- .2	
DX 21: APPENDICITIS				
CR HOSPITALS	28.4	18.7	-9.7	-1.4
COMPARISON HOSPITALS	28.6	17.7	-11.1	
DX 22: OTHER				
CR HOSPITALS	23.9	20.6	-3.3	+ .8
COMPARISON HOSPITALS	21.8	19.7	-2.5	

TABLE 5.19

% Long Stays Regression Analysis by Diagnosis Group: Medicare

Dependent Variable: % Long Stays Form: % Long Stays = $\beta_0+\beta_1$STYPE+β_2TIME+β_3(STYPE·TIME) +ϵ

Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-value	P	Estimate	t-value	P		
1. Hypertension	-3.6390	-2.00	.0455	-1.5470	- .56	.5788	729	725
2. Pneumonia	-1.7001	-1.14	.2539	-1.4772	- .57	.5685	764	760
3. Heart Failure	-1.1317	- .83	.4063	.8410	.36	.7167	763	759
4. Urinary Tract Infection	- .9002	- .39	.6984	- .2138	- .06	.9515	656	652
5. Ulcer	-6.6650	-3.57	.0004	3.4268	1.15	.2496	723	719
6. Cholecystitis/Choletithiasis	-2.9235	-1.81	.0711	.7104	.26	.7924	751	747
7. Inguinal Hernia	-4.2620	-2.35	.0189	-1.8416	- .60	.5489	713	709
8. Hyperplasia Prostate	-2.1440	-1.38	.1671	-4.6507	-1.81	.0701	691	687
9. Disc Displacement	2.9935	.92	.3565	-10.5800	-2.02	.0444	475	471
10. Complications & Adverse Reactions	- .6726	- .37	.7113	-2.4391	- .82	.4137	681	677
11. Cerebrovascular Disease	-2.3691	-1.75	.0804	3.0920	1.42	.1572	783	779
12. Chronic Ischemic Heart Disease	-6.0800	-5.37	.0001	3.2681	1.79	.0745	785	781
13. Acute Myocardial Infarction	-9.0229	-5.28	.0001	1.1185	.41	.6833	720	716
14. Diabetes	-3.4099	-2.01	.0447	-1.4548	- .54	.5901	742	738
15. Malignant Neoplasm of Breast	-2.8060	-1.17	.2440	-2.5402	- .64	.5208	570	566
16. Delivery		N.O.			N.O.		---	---
17. Hypertrophy Tonsils/ Adenoids		N.O.			N.O.		---	---
18. Fracture of Femur	-1.5641	- .63	.5274	-3.0967	- .82	.4138	643	639

TABLE 5.19

% Long Stays Regression Analysis by Diagnosis Group: Medicare
Continued

Dependent Variable: % Long Stays Form: % Long Stays = $\beta_0+\beta_1$STYPE$+\beta_2$TIME$+\beta_3$(STYPE·TIME) $+\in$

Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-value	P	Estimate	t-value	P		
19. Cataract	-11.7999	-6.11	.0001	-1.3235	- .37	.7105	570	566
20. Neuroses	1.7814	.59	.5532	-1.6355	- .34	.7330	515	511
21. Appendicitis	-9.7367	-1.78	.0761	-1.4065	- .15	.8834	271	267
22. Other	-3.4060	-5.31	.0001	1.2890	1.26	.2083	810	806

successful in reducing % long stays than did the comparison hospitals. The diagnosis groups where the greatest net effects were seen were for Ulcer (Dx #5), Cerebrovascular Disease (Dx #11), and Chronic Ischemic Heart Disease (Dx #12) with net differences in % long stays of 3.4%, 3.1%, and 3.3% respectively. However, the regression analysis results in Table 5.19 indicate that none of the effects for the above three groups were statistically significant at $P < .05$. Indeed, only one of the diagnostic-specific equations revealed a statistically significant $\hat{\beta}_3$; i.e., a large (-10.8%) and moderately significant result was observed for $\hat{\beta}_3$ in the Disc Displacement (Dx #9) equation. Because a negative sign was observed for $\hat{\beta}_3$, concurrent review activities appear to have had an impact which was opposite from expectations. Indeed, upon inspection of the actual % long stays on Table 5.18, we see that while the % long stays increased very slightly (from 25.5% to 28.6%) for concurrent review hospitals, there was a large drop in the comparison hospitals (from 25.6% to 17.9%). The reason for this result is unclear and is deserving of further investigation.

5.4 ANALYSIS OF CHANGES IN DIAGNOSTIC MIX

In this section, the frequency and percent distribution of patients and patient days for the twenty-two diagnosis groups included in the study are analyzed for the pre-review and post-review periods for both the concurrent review and comparison hospitals. The purpose of the analysis was to determine if the PSRO activity resulted in a shift in the mix of diagnoses for the Medicare patients in the sample. Both the number of patients and the number of patient days were used as indicator of changes in case mix. The null hypothesis to be tested is given below:

H_0: The change in the proportion of patients (patient days) by diagnosis group is equal for the concurrent review and comparison hospitals.

H_1: The proportion of patients (patient days) in concurrent review hospitals by diagnosis group in the pre-review period is equal to the proportion of patients (patient days) by diagnosis group in the post-review period.

As discussed in Section 3.2.8 it is possible to use an index number technique to obtain insight into these questions. Two indexes were derived therein: a casemix index (I) measuring the percentage of the secular change in ALOS which could be attributed to changes in the distribution of diagnosis groups (casemix changes); and an ALOS index (I') measuring the percentage of the secular change in ALOS which could be attributed to changes in diagnostic mix independent of any changes in diagnosis-specific ALOS. The results for Medicare patients are summarized again in Tables 5.20 and 5.21.

Table 5.20

Index Values for Case Mix and ALOS Adjustments: by Hospital Group: MEDICARE

Index Hospital Group	Case Mix Adjustment (I)	ALOS Adjustment (I')
Concurrent Review Hospitals	1.0026	.9941
Comparison Hospitals	1.0020	.9627

Table 5.21

Expected Post Period ALOS for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

Hospital Group \ Expected Post Period ALOS	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals Observed Pre-Period ALOS = 10.7921	10.8200	10.1886
Comparison Hospitals Observed Pre-Period ALOS = 10.7240	10.7448	10.3243

While the index number technique does not lend itself readily to statistical tests of significance, it is clear from the results that there was virtually no pre-post change in casemix for either the concurrent review (I = 1.0026) review or the comparison hospitals (I = 1.0020). However, as discussed in Section 3.2.8, the diagnostic-specific ALOS appeared to decrease for both the concurrent review (I' = 0.9441) and the comparison hospitals (I' = 0.9627). Moreover, the difference in I' for the comparison versus the study hospitals (0.9627 - 0.9441 = 0.0186) is consistent with the 0.2 day differential observed throughout between secular decreases for the comparison versus the concurrent review groups. These results indicate that the additional decreases in ALOS observed for the concurrent review relative to the comparison hospitals are not an artifact produced by secular

differentials in case mix. Table 5.22 presents the distribution of patients by diagnosis and the pre-review, post-review differences in the proportions for the concurrent review and comparison hospitals. Twelve of the diagnosis groups for the concurrent review hospitals exhibit significant shifts in the proportions between the pre-review and post-review periods while only six of the diagnoses in the comparison hospitals shift significantly. The largest shifts observed for the concurrent review hospitals occur for Chronic Ischemia Heart Disease and the "other" category with shifts of -1.11 and 1.47 percentage points, respectively. It is interesting to note that the "other" diagnosis group increased its proportion significantly for the concurrent review hospitals but not for for the comparison groups.

The shift in the distribution of diagnosis groups is also apparent when the changes in the days of care by diagnosis group are examined. Table 5.23 shows that the shifts in proportions of days of care between the pre-review and post-review periods for the concurrent review hospitals were satistically significant ($p<.05$) for seventeen of the diagnosis groups. The largest percent shift was for the Other Diagnosis category which showed an increase of 1.37 percentage points between the pre-review and post-review periods for concurrent hospitals. The largest decrease for the CR hospital group was for Acute Myocardial Infarction which dropped from 6.72% to 5.25% of the total patient days. However, for both of these diagnosis groups, the proportion of patient days in the comparison hospitals also shifted significantly.

Table 5.22

CHANGES IN DIAGNOSTIC MIX, PRE-REVIEW - POST-REVIEW PERIODS FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Difference	Pre	Post	Difference
DX 1:						
#	1,424	1,323		969	972	
%	1.78	1.59	-0.19*	2.08	1.91	-0.17
DX 2:						
#	1,774	2,182		878	1,149	
%	2.22	2.62	0.40*	1.88	2.26	0.38*
DX 3:						
#	2,374	2,893		1,193	1,531	
%	2.97	3.47	0.50*	2.56	3.01	0.45*
DX 4:						
#	704	704		533	499	
%	.88	.84	-0.04	1.14	0.98	-0.16*
DX 5:						
#	1,238	1,151		716	756	
%	1.55	1.38	-0.17*	1.54	1.48	-0.06
DX 6:						
#	1,983	1,864		1,008	1,061	
%	2.48	2.24	-0.24*	2.16	2.08	-0.08
DX 7:						
#	1,405	1,279		695	679	
%	1.76	1.53	-0.23*	1.49	1.33	-0.16*
DX 8:						
#	2,541	2,487		1,365	1,456	
%	3.18	2.98	-0.20*	2.93	2.86	-0.07

Table 5.22
(continued)

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Difference	Pre	Post	Difference
DX 9:						
#	380	378		195	251	
%	.48	.45	-0.03	.42	.49	0.07
DX 10:						
#	1,086	1,245		626	683	
%	1.37	1.49	0.13*	1.34	1.34	0.0
DX 11:						
#	2,904	3,132		1,699	1,964	
%	3.63	3.76	0.13	3.65	3.86	0.21
DX 12:						
#	5,214	4,512		2,949	2,916	
%	6.52	5.41	1.11*	6.33	5.73	-0.60*
DX 13:						
#	1,604	1,795		986	1,093	
%	2.01	2.15	0.14*	2.12	2.15	0.03
DX 14:						
#	1,373	1,366		872	830	
%	1.72	1.64	-0.08	1.87	1.63	-.24*
DX 15:						
#	698	680		367	409	
%	.87	.82	-0.05	.79	.80	0.01
DX 17:						
#	12	7		3	5	
%	.02	.01	-0.01	.01	.01	0.0
DX 18:						
#	1,018	1,044		689	783	
%	1.27	1.25	-0.02	1.48	1.54	0.06

Table 5.22
(continued)

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Difference	Pre	Post	Difference
DX 19:						
#	4,451	4,332		1,686	1,899	
%	5.57	5.20	-.37*	3.26	3.72	0.11
DX 20:						
#	517	475		280	334	
%	.65	.57	-0.08	.60	.66	0.06
DX 21:						
#	116	139		56	62	
%	.15	.17	0.02	.12	.12	0.0
DX 22:						
#	47,148	50,388		28,818	31,597	
%	58.96	60.43	1.47*	61.86	62.04	0.18

*Shift in the proportion is significant at p = .05.

Table 5.23

CHANGES IN DAYS OF CARE, PRE-REVIEW - POST-REVIEW PERIODS FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICARE

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Difference	Pre	Post	Difference
DX 1:						
#	13,527	12,219		9,733	8,999	
%	1.57	1.43	-.14*	1.95	1.71	-.24*
DX 2:						
#	20,625	24,842		10,947	14,088	
%	2.39	2.91	.52	2.19	2.67	.48*
DX 3:						
#	27,817	33,697		14,484	17,840	
%	3.22	3.95	.73	2.90	3.38	.48
DX 4:						
#	5,960	5,864		4,598	3,970	
%	.69	.69	.00	.92	.75	-.17*
DX 5:						
#	15,491	13,546		8,360	8,500	
%	1.80	1.59	-.21	1.67	1.61	-.06
DX 6:						
#	24,945	22,553		12,665	13,072	
%	2.89	2.65	-.24	2.54	2.48	-.06
DX 7:						
#	10,822	9,084		5,660	5,005	
%	1.25	1.07	-.18	1.13	.95	-.18
DX 8:						
#	27,456	25,539		15,869	15,491	
%	3.18	3.00	-.18	3.18	2.94	-.24*
DX 9:						
#	5,230	5,287		2,359	2,932	
%	.61	.62	.01	.47	.56	.09
DX 10:						
#	9,555	11,671		5,838	5,878	
%	1.11	1.37	.26*	1.17	1.11	-.06*
DX 11:						
#	30,962	31,112		17,794	20,448	
%	3.59	3.65	.06*	3.56	3.88	.32*

Table 5.23
(continued)

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Difference	Pre	Post	Difference
DX 12:						
#	58,031	44,797		31,787	29,438	
%	6.72	5.25	-.47	6.36	5.58	-.78*
DX 13:						
#	31,029	31,201		18,705	19,527	
%	3.60	3.66	.06	3.75	3.70	-.05
DX 14:						
#	15,253	14,662		9,823	8,591	
%	1.77	1.72	-.05*	1.97	1.63	.03
DX 15:						
#	8,445	7,831		4,415	4,821	
%	.98	92	0.06*	.88	.91	.03
DX 16:						
#	N.O.	N.O.		N.O.	N.O.	
%						
DX 17:						
#	43	31		16	17	
%	0.00	0.00	.00	0.00	0.00	.00
DX 18:						
#	23,706	24,207		15,334	17,047	
%	2.75	2.84	.09	3.07	3.23	.16*
DX 19:						
#	26,569	21,293		10,762	9,689	
%	3.08	2.50	-.58*	2.15	1.35	-.31*
DX 20:						
#	6,117	5,943		3,706	4,369	
%	.71	.70	-.01	.74	.83	.09*
DX 21						
#	1,649	1,775		792	745	
%	.19	.21	.02*	.16	.14	-.02*
DX 22						
#	499,709	505,423		295,788	316,745	
%	57.91	59.28	1.37	59.22	60.08	0.86*

N.O. = Not Observed
* - Shift in proportion significant at $p < .05$.

Based on the results as presented in the table, it would appear the null hypotheses regarding the absence of a shift in the case mix should be rejected. However, it must be recognized that the large number of patients and patient days in the study contribute to even very small shifts in the proportions being statistically significant. In the absence of additional diagnosis specific utilization data, particularly admission rate information, it is difficult, if not impossible, to make a meaningful interpretation of observed statistically significant shifts in the diagnostic mix.

5.5 ADMISSIONS AND DAYS OF CARE

It was not the primary purpose of this study to examine the impact of PSRO concurrent review activity on the changes in admissions to, and days of care provided in, the hospitals included in the sample. Because of the nature of the study design and the limitations of the sampling plan, there was not available the appropriate eligibility data needed to calculate admission rates or days of care per 1000 population. Therefore, it is not possible to determine if any observed changed in the number of admissions or the days of care have resulted from PSRO impact on hospital utilization, or from changes in the eligibility base, or from changes in other variables not accounted for in the design.

It is for these reasons that the two hypotheses listed below could not be fully addressed within the context of this study.

H_1: THE CHANGE IN THE ADMISSION RATE FOR CONCURRENT REVIEW HOSPITALS IS EQUAL TO THE CHANGE IN THE ADMISSION RATE FOR COMPARISON HOSPITALS.

H_2: THE CHANGE IN THE HOSPITAL DAYS OF CARE RATE FOR CONCURRENT REVIEW HOSPITALS IS EQUAL TO THE CHANGE IN THE HOSPITAL DAYS OF CARE RATE FOR COMPARISON HOSPITALS.

The closest approximation of an analysis of the changes in admission rates and days of care rate that may be achieved with the limited data available in this study is the pooling of admissions and days of care across concurrent review and comparison hospitals. The change in the proportion of admissions and hospital days of care in concurrent review hospitals versus comparison hospitals may then be calculated and tested for significance. The distributions of admissions and hospital days of care are given in Tables 5.24 and 5.25. As may be seen from the tables, the proportion of admissions to concurrent review hospitals declined by 1.1% and the hospital days of care declined by 1.5% between the pre-review and post-review periods. Given the large number of observations, these observed changes are significant ($p<.05$). If these measures may be considered as appropriate proxies for the admission rate and hospitals days of care rate it may be indicated that PSRO review had the effect of reducing slightly the admission rate and days of care rate in concurrent review hospitals as contrasted with comparison hospitals. However, the assumptions that must be made to support this conclusion may not be warranted in that the analysis assumes essentially no change in the proportionate share of admissions and hospitals days of care for the concurrent review hospitals and comparison hospitals in their respective hospital service areas between the 1975 pre period and the 1976 post period. Furthermore, the analysis assumes that the population in the hospital service areas was relatively stable and that no major changes have occurred in the relative

Table 5.24

DISTRIBUTION OF ADMISSIONS BY PRE-REVIEW, POST- REVIEW PERIOD FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS

PERIOD	PRE-REVIEW		POST-REVIEW	
Hospital Group	N	%	N	%
Concurrent Review Hospitals	79,965	63.2	83,376	62.1
Comparison Hospitals	46,583	36.8	50,929	37.9
TOTAL	126,548	100.0	134,305	100.0

Table 5.25

DISTRIBUTION OF HOSPITAL DAYS OF CARE BY PRE-REVIEW, POST-REVIEW PERIOD FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS

PERIOD	PRE-REVIEW		POST-REVIEW	
Hospital Group	N	%	N	%
Concurrent Review Hospitals	862,941	63.3	852,577	61.8
Comparison Hospitals	499,435	36.7	527,212	38.2
TOTAL	1,362,376	100.0	1,379,789	100.0

capacities of the two hospital groups. Because of the lack of eligibility data and the small proportionate shift (although statistically significant), it is not felt that there is sufficient evidence to reject the null hypotheses that the admission rates and the days of care rate have remained constant.

5.6 ANALYSIS OF LSS EXCLUSIONS: MEDICARE

Transfers, patients with stays over 100 days, deaths and patients with age discharge status or stay unrecorded are excluded from the CPHA LSS Program and therefore from the analyses described earlier in this chapter. In this section, data on these excluded patients are analyzed to determine if observed changes from pre-to-post for these excluded patients have varied between the concurrent review hospitals and the comparison hospitals.

An overall summary of the Medicare exclusions is shown in Table 5.26. The first portion of this table shows the proportion of total patients (with calculable LOS) which were excluded because of transfer, stay over 100 days, death or age or discharge status unrecorded. Slightly higher proportions of patients were excluded for the concurrent review hospitals than for the comparison hospitals both in the pre and post periods. However, there was very little change from pre to post within each hospital group. The exclusion rate for comparison hospitals did not change at all from pre to post while the exclusion rate for concurrent review hospitals dropped .3%. It must be noted that lack of eligibility data makes it difficult to interpret changes in admission patterns. While the number of excluded patients actually increased from pre to post, the total number of patients increased at a faster rate, causing the observed drop in the proportion of excluded patients.

A different picture is presented by examining the number of excluded days of care as a proportion of total patient days. The proportion of excluded days of care increased by .5% from pre to post for the concurrent review hospitals and decreased by .7% for the comparison hospitals. While these proportions are extremely small, the large number of patient days in the sample makes even these small proportions account

TABLE 5.26

SUMMARY OF

MEDICARE EXCLUSIONS

	Concurrent Review			Comparison		
	Pre	Post	Post-Pre	Pre	Post	Post-Pre
Total # of patients*	100,864	104,747		57,171	62,484	
# of excluded patients*	20,899	21,371		10,588	11,555	
Excluded patients as a proportion of total patients	.207	.204	-.003	.185	.185	
Total patient days*	1,224,285	1,217,594		696,689	728,500	
Excluded Patient days*	361,344	365,017		197,254	201,288	
Excluded days as a proportion of total days	.295	.300	+.005	.283	.276	-.007
ALOS * for excluded patients	17.29	17.08	-.21	18.63	17.42	-1.21

* For patients with calculable LOS

TABLE 5.27

Medicare Exclusions By Reason for Exclusion

	CR			$\widetilde{CR}$		
	Pre	Post	Post-Pre	Pre	Post	Post-Pre
Total # of patients*	100,864	104,747		57,171	62,484	
# of excluded patients*	20,899	21,371		10,588	11,555	
Transfers						
#	12,127	12,674		5,854	6,600	
proportion of total patients	.120	.121	+.001	.102	.106	+.004
Stays over 100 days						
#	73	73		57	37	
proportion	.001	.001		.001	.001	
Deaths						
#	8,368	8,287		4,620	4,858	
proportion	.083	.079	-.004	.081	.078	-.003
Age or discharge status not recorded						
#	331	337		57	60	
proportion	.003	.003		.001	.001	

* For patients with calculable LOS

for over 5,000 days of care. The primary reason for these changes in days of care can be seen from the ALOS for excluded patients which dropped 1 day more for the comparison hospitals than for the concurrent review hospitals.

Medicare exclusions are broken out by the reason for exclusion in Table 5.27. Extremely small increases in the transfer rate and decrease in the death rate were observed for both concurrent review and comparison hospitals. All of these changes, however, were less than .5% of total patients, implying that at least in terms of the number of patients excluded for each reason our sample of studied patients was consistent between the two time periods for both groups of hospitals.

ALOS statistics for transfers, stays over 100 days, and deaths are shown in Table 5.28. ALOS for transfers dropped for both concurrent and comparison hospitals, perhaps as a result of more effective patient management procedures. For stays over 100 days, ALOS increased for concurrent review hospitals while decreasing for the comparison hospitals. The reasons for this difference between the two hospital groups is unclear, furthermore, the extremely small number of patients with stays over 100 days precludes drawing any major conclusions from this finding. A similar pattern was observed for ALOS for patients who died; concurrent review hospitals showed an increase in ALOS while comparison hospitals showed a decrease.

In order to summarize the overall impacts of exclusions, differences between patients studied and total patients are presented in Table 5.29. While differences do exist between the total patient population and our studied patients, we believe that the uncertainties associated with the excluded patients justify the use of the LSS patients as our sampling frame.

TABLE 5.28

ALOS for Medicare Exclusions

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Post-Pre	Pre	Post	Post-Pre
All exclusions*	17.29	17.08	-.21	18.63	17.42	-1.21
Transfers	19.37	18.35	-1.02	19.89	19.11	-.78
Stays over 100 days	141.55	160.88	+19.33	200.39	167.76	-32.63
Deaths	13.31	14.00	+.69	14.74	13.40	-1.34

* For patients with calculable LOS

TABLE 5.29
PATIENTS STUDIED AND TOTAL NUMBER OF PATIENTS
MEDICARE

	ALL PATIENTS				STUDY PATIENTS			
	CR Hospitals		Comparison		CR Hospitals		Comparison	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Admissions*	100,864	104,747	57,171	62,484	79,965	83,376	46,583	50,929
Patient Days*	1,224,285	1,217,594	696,689	728,500	862,941	852,577	499,435	527,212
ALOS*	12.14	11.62	12.19	11.66	10.79	10.22	10.72	10.36

* For patients with calculable LOS

5.7 STAGING ANALYSIS

As was described in Section 3.3 a staging analysis was performed for 23 selected diagnoses for which staging citeria were available. Included in the analysis were 83,874 Medicare patients who could be included in one of these categories. Two separate types of analysis were performed using the stage variable; a case mix analysis to evaluate changes in the severity of patients in a given diagnosis group from pre to post, and an LOS analysis to evaluate disease and stage specific changes in ALOS.

5.7.1 Case Mix Severity

For purposes of analysis of case mix severity the 23 stage diagnoses were split into two groups. The first group contains those diagnoses in which hospitalization is not always necessary for stage 1 patients. The second group contains the remaining 14 diagnoses, in which hospitalization is indicated at Stage 1. For each staged diagnosis, a 3 x 2 frequency table was generated where the rows represent the stage (1 - 3) and the columns represent time (pre vs post). Each cell in the table contained the # of admissions falling into the appropriate stage/time category for that diagnosis. Separate tables were generated for CR hospitals and for non-CR hospitals and Chi-square tests were run on each frequency table to test for the significance of shifts in severity mix.

Table 5.30 summarizes, for the nine Group 1 diagnoses, the proportion of Stage 1 patients in each diagnosis. For both CR hospitals and non-CR hospitals 8 of the 9 diagnosis groups showed decreases in the proportion of Stage 1 patients from pre to post indicating an increase in the severity level for both CR and non-CR hospitals. Those shifts in severity levels that were found to be statistically significant using the Chi-square test on the full stage by time frequency table are indicated by an asterisk in Table 5.30. For CR hospitals,

TABLE 5.30

MEDICARE

CASE MIX SEVERITY

DX	CR HOSPS. - PROPORTION STAGE 1 PRE	POST	POST-PRE	$\tilde{CR}$ HOSPS. - PROPORTION STAGE 1 PRE	POST	POST-PRE
DIARRHEA (GASTROENTERITIS)	.84	.79	-.05 *	.87	.84	-.03
DIABETES MELLITUS	.54	.51	-.03 *	.57	.55	-.02
ALCOHOLISM	.28	.16	-.12 *	.33	.31	-.02
HYPERTENSION	.20	.16	-.04 *	.24	.19	-.05 *
PEPTIC ULCER DISEASE	.54	.52	-.02 *	.59	.55	-.04 *
EXTERNAL HERNIA	.90	.89	-.01	.92	.89	-.03
URINARY TRACT INFECTION	.85	.84	-.01	.85	.86	+.01
RENIGN PROSTATIC HYPERTROPHY	.86	.84	-.02	.86	.85	-.01
RHEUMATIOD ARTHRITIS	.03	.04	+.01	.05	.02	-.03
TOTAL	.60	.56	-.04*	.62	.59	-.03 *

* Chi-Square tests were run on each 3 x 2 matrix of Stage (1 - 3) by time (Pre/Post). Each cell contained the # of admissions falling into the appropriate stage and the category for that diagnosis. The asterisk (*) indicates a significant ($p < .05$) result for the Chi-Square test for that diagnosis.

5 of the 8 Chi-Square valves were significant ($p < .05$). While for non-CR hospitals 2 of the 8 were significant.

Similar data for the 14 diagnoses for which hospitalization is indicated at Stage 1 are shown in Table 5.31. Of these 14 diagnoses, 8 showed decreases in the proportion of Stage 1 patients for the CR hospitals while 9 diagnoses showed decreases in the proportion of Stage 1 patients for the non-CR hospitals

While both the Group 1 and Group 2 diagnoses showed general trends towards a more severe case-mix these shifts were more pronounced for the 9 Group 1 diagnoses in which hospitalization is not always necessary at Stage 1. While the lack of data on changes in the Medicare eligibles limits the interpretation of these findings, they are never the less suggestive of a number of phenomena.

The general increase in severity levels for the Group 1 diagnoses may be indicative of more appropriate use of the hospital, both in the CR and non-CR hospitals. It is possible that many of the Stage 1 patients are now being treated at ambulatory level. If this is true it would make the primary study finding of overall reductions in ALOS even more significant since it implies a decrease in ALOS at the same time that the case-mix was becoming more severe.

The findings for the Group 2 diagnoses are more difficult to interpret. While it is true that the shifts towards a more severe case-mix were less pronounced than the Group 1 diagnoses, these shifts still occured for over half the diagnoses in this group. Without further information on readmissions and eligibility statistics it is not possible to ascertain whether the lower proportions of Stage 1 patients resulted from problems in early detection or from improvements in the treatment of advanced stage illness that required rehospitalizations, or from other changes in the quality of patient care.

TABLE 5.31

MEDICARE

CASE MIX SEVERITY

DIAGNOSES REQUIRING HOSPITALIZATION AT STAGE 1

	CR HOSPS. - PROPORTION STAGE 1			$\tilde{CR}$ HOSPS. - PROPORTION STAGE 1		
DX	PRE	POST	POST-PRE	PRE	POST	POST-PRE
COLON CARCINOMA	.56	.54	-.02	.58	.57	-.01
CARCINOMA OF THE BREAST	.58	.51	-.07 *	.60	.56	-.04
CARCINOMA OF THE CERIVX	.85	.88	+.03	.85	.89	+.04
CARCINOMA OF THE PROSTATE	.65	.65	0	.68	.67	-.01
MYOCARDIAL INFARCTION	.70	.68	-.20*	.72	.71	-.01*
THROMBOPHLEBITIS (PERIPHERAL)	.99	.98	-.01	.99	.98	-.01
BACTERIAL PHEUMONIA	.98	.97	-.01	.98	.96	-.02
APPENDICITIS	.36	.37	+.01	.47	.41	-.06
DIVERTICULITIS	.80	.84	+.04*	.83	.83	0
ULCERATIVE COLITIS	.76	.78	+.02	.63	.69	+.06
CIRRHOSIS OF THE LIVER	.75	.73	-.02	.73	.77	+.04
CHOLECYSTITIS	.87	.86	-.01	.89	.86	-.03*
PANCREATITIS	.77	.73	-.04	.85	.78	-.07
KIDNEY: RENAL CALCULUS DISEASE	.75	.76	+.01	.70	.74	+.04
TOTAL	.75	.73	-.02 *	.76	.74	-.02 *

* (Same footnote as in prior table)

An important proviso must be added to the above discussion. Stage assignments were made based on diagnostic information recorded on the medical record and abstracted by records personnel. It is possible that both PSRO and the pressure of malpractice suits has led to more detailed recording of diagnoses and complications. To the extent that this has occured, the apparent case-mix severity changes may result from documentation improvements rather than "real" changes in severity. If this is the case, however, these documentation improvements may be worthwhile in their own right.

5.7.2 ALOS Analysis

The results of the staging analysis of ALOS are summarized in Table 5.32. ALOS data pre/post and CR/non-CR were analyzed for the 23 diagnoses. The regression model described in Section 3.3 was run for all patients on each diagnosis and separately for patients in each stage of each diagnosis group. For the CR hospitals 7 of the 23 diagnosis groups showed statistically significant ($p < .05$) decreases in ALOS pre to post, while one diagnosis (Alcoholism) showed a significant increase. Of the 7 diagnoses in which ALOS in CR hospitals decreased significantly, in only one case (Cirrhosis of the Liver) was that decrease significantly greater than the change for non-CR hospitals. These results are consistent with the results of the overall ALOS analysis reported earlier in Section 5.

Review of the results for individual stages for the seven diagnoses with significant decreases in ALOS shows great deal of consistency with the overall results. For six of the seven diagnoses ALOS decreased for all 3 stages. While this is certainly a small number of diagnoses it does imply that for these diagnoses the overall effects of CR were experienced across the spectrum of severity levels. For some of the other diagnoses, however, different impacts on ALOS were observed between the stages implying that it may be necessary to consider disease severity when evaluating PSRO effectiveness.

TABLE 5.32

TABLE 5.32

MEDICARE

SUMMARY OF CHANGE IN ALOS (POST-PRE)

DX	ALL ADMISSIONS		STAGE 1		STAGE 2		STAGE 3		STAGE 4	
	CR	~CR	CR	~CR	CR	~CR	CR	~CR	CR	~CR
DIARRHEA (GASTROENTERITIS)	+.19	-1.69	+.25	-1.76	-.95	-1.20	+2.80	-3.62		
DIABETES MELLITUS	-.44	-.74	-.78	+.03	-.32	-1.22	+.70	-5.79		
ALCOHOLISM	+2.46*	-.99	+.44	-1.61	+2.54	-2.62	+1.96	+1.90		
HYPERTENSION	+.41	-.57	-.06	-1.32	-.94	-.56	+.19	-.76		
PEPTIC ULCER DISEASE	-.60	-.54	-.83	-.61	-.61	-.41	+.26	-8.40		
EXTERNAL HERNIA	-.85*	-.62	-.72	-.79	-2.30	+.41	Insufficient Data			
URINARY TRACT INFECTION	+.17	+.71	+.02	+.93	+1.60	+1.59	-1.15	-2.48		
BENIGN PROSTATIC HYPERTROPHY	-.58*	-.85	-.53	-1.05	-.11	+.44	-2.82	-1.43		
RHEUMATOID ARTHRITIS	-1.21	-2.14	-5.89	-6.98	-4.20	-4.60	-1.00	-1.91		
COLON CARCINOMA	-1.20	-.01	-1.25	-1.13	-.29	-13.27	-1.06	+2.02		
CARCINOMA OF THE BREAST	-1.19*	+.43	-.71	-.19	+.04	-2.15	+2.22	+6.76	-3.83	+1.09
CARCINOMA OF THE CERVIX	-2.67	-5.61	-2.86	-4.52	-2.65	-2.92	Insufficient Data			
CARCINOMA OF THE PROSTATE	-1.37*	-.55	-1.25	+.47	-4.19	-3.82	-1.13	-2.56		
MYOCARDIAL INFARCTION	-1.19*	-1.44	-1.17	-.85	-.79	-1.66	-1.66	-5.67		
THROMBOPHLEBITIS (PERIPHERAL)	+.21	-.23	+.18	-.33	+2.40	+6.05	Insufficient Data			
BACTERIAL PNEUMONIA	+.27	-.72	+.53	-.72	Insufficient Data					
APPENDICITIS	-2.55*	-2.53	-2.97	-4.40	-2.46	-1.95	-.95	+.29		
DIVERTICULITIS	+.04	+1.59	+.74	+.61	-2.57	+6.84	+3.30	+4.55		
ULCERATIVE COLITIS	+3.59	+10.84	+4.76	+8.03	+.88	+11.07	Insufficient Data			
CIRRHOSIS OF THE LIVER	-2.66*	+1.78	-3.10	+.40	-1.86	+7.70	-.42	+3.28		
CHOLECYSTITIS	+.14	-.16	+.01	-.36	-.41	-1.23	+1.80	+.74		
PANCREATITIS	-.12	-.27	-1.34	-.91	+.95	+4.01	Insufficient Data			
KIDNEY: RENAL CALCULUS DISEASE	-.32	-1.62	-.02	-1.28	-.17	-1.91	-2.751	-1.32		

* Implies a significant ($p<.05$) reduction in ALOS from pre to post for the CR hospitals

5.7.3 ALOS Adjusted for Staging Case Mix Severity

Partitioning each of the 23 diagnoses by stage provided us with the means to adjust ALOS for staging case mix severity, both for individual and groups of diagnoses. The Paasche-Laspeyres (LOS-Casemix) adjustment technique used was described in detail in Section 3.2.8. The difference between its earlier application and its current use is that here we are considering each stage of a diagnosis as a special "sub-diagnosis." Accordingly, the $ALOS_i$'s and n_i's used in the Paasche-Lespeyres adjustment equations pertain to stages within a specified diagnosis; not (as before) to the diagnosis itself.

For the PSRO concurrent review and comparison hospital groups, staging case mix and ALOS adjustments were done on all 23 diagnoses as a whole, the 9 Group 1 diagnoses, the 14 Group 2 diagnoses, and then separately on each of the 23 individual staged diagnoses.

The results for all 23 diagnoses as a group are shown in Table 5.33A. Purely on the basis of changes in staging case mix between the two periods, the overall ALOS would have been approximately 1% higher in the post (vs. pre) period for both the PSRO concurrent review and comparison hospital groups. As a result of stage-specific decreases in ALOS, however, the overall ALOS would have been about 4% and 5% lower in the post (vs. pre) period for the PSRO concurrent review and comparison hospitals respectively.

When applied to the 9 Group 1 diagnoses and the 14 Group 2 diagnoses separately (Tables 5.33B and 5.33C), the staging case mix adjustment shows that there was no "severity" effect either for the concurrent review or the comparison hospitals for the 14 Group 2 diagnoses (for which hospitalization is indicated at Stage I). However, based on changes in staging case mix between the post and pre periods, the overall ALOS would have been a little over 1% higher in the post period for both PSRO and comparison hospitals for the 9 Group 1

Table 5.33A

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

All 23 Diagnoses

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.0067	0.9610
Comparison Hospitals	1.0101	0.9512

Table 5.33B

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

9 Group 1 Diagnoses

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.0117	0.9701
Comparison Hospitals	1.0108	0.9358

Table 5.33C

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

14 Group 2 Diagnoses

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.9989	0.9516
Comparison Hospitals	1.0056	0.9681

diagnoses (for which hospitalization is not always necessary at Stage 1). This result is consistent with the general increase in severity levels observed previously for the Group 1 diagnoses, and it provides further evidence to indicate more appropriate hospital utilization both in the PSRO concurrent review and comparison hospital groups. Table 5.33B and 5.33C also show that there was a secular decrease in stage-specific adjusted ALOS for both groups of hospitals and for both diagnosis groups. However, while the decrease in stage-specific adjusted ALOS was approximately 3% greater in the comparison hospitals for the Group 1 diagnoses, the reverse was true for the Group 2 diagnoses (almost 2% greater decrease for PSRO concurrent review hospitals). These results would seem to indicate that PSRO concurrent review had a differential ALOS impact based on diagnosis type (appropriateness of early hospital admission) and stage of severity.

Staging case mix and ALOS admustments applied to individual diagnoses produced results which were consistent with our earlier analysis. All 7 of the diagnoses which showed significant PSRO concurrent review decreases in ALOS based on the regression model showed similar decreases in stage-specific adjusted ALOS (Tables 5.33D through 5.33J). In addition, for 4 of the 7 diagnoses (External Hernia, Carcinoma of the Breast, Carcinoma of the Prostate and Cirrhosis of the Liver) the decreases were greater for the PSRO concurrent review hospitals than for the comparison hospitals. Based purely on changes in staging case mix pre to post, the ALOS would have been the same or higher in the post period for these 7 diagnoses, for both study and control hospitals, supporting our finding of an overall secular decrease in ALOS coupled with a secular increase in case mix severity.

Two diagnosis-specific results were particularly striking:

- For Carcinoma of the Breast the staging case mix adjustment indicated that ALOS should be over 2% higher in the post (vs. pre) period for the PSRO concurrent review hospitals based purely on changes in staging case mix. For the comparison hospitals this predicted increase was slightly under 1%. The stage-specific ALOS adjustments, however, actually showed an ALOS decrease of over 10% (post vs. pre) for the PSRO concurrent review hospitals and a 2.7% increase for the comparison group. (Table 5.33F)

- For Cirrhosis of the Liver there was virtually no change in staging case mix severity for either group, but the PSRO concurrent review hospitals experienced a stage-specific ALOS decrease of over 15% while the comparison group showed a 15% increase in adjusted ALOS. (Table 5.33J)

Complete results for all 23 diagnoses are presented in Appendix C.

Table 5.33 D

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

EXTERNAL HERNIA

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00367	0.89463
Comparison Hospitals	1.00431	0.91702

Table 5.33 E

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

BENIGN PROSTATIC HYPERTROPHY

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00600	0.94428
Comparison Hospitals	1.00704	0.92096

Table 5.33 F

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

CARCINOMA OF THE BREAST

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.02035	0.89874
Comparison Hospitals	1.00849	1.02695

Table 5.33 G

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

CARCINOMA OF THE PROSTATE

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99920	0.89786
Comparison Hospitals	1.00418	0.95595

Table 5.33 H

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

MYOCARDIAL INFARCTION

Hospital Group \ Index	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99235	0.93154
Comparison Hospitals	0.99845	0.91836

Table 5.33 I

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

APPENDICITIS

Hospital Group \ Index	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99707	0.84092
Comparison Hospitals	1.01509	0.80260

Table 5.33 J

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

CIRRHOSIS OF THE LIVER

Hospital Group \ Index	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00035	0.84313
Comparison Hospitals	1.00313	1.15183

Footnotes to Section 5

1. Inpatient Utilization of Short-Stay Hospitals By Diagnosis, U.S. 1973. NCHS, National Health Survey.

6. MEDICAID UTILIZATION ANALYSIS

6.1 INTRODUCTION

In this chapter the analysis and findings related to the effects of PSRO concurrent review activity on Medicaid utilization are presented. The analysis is discussed in six major sections according to the type of utilization dependent variable under investigation.

Section 6.2 describes the impact of concurrent review activity on the average length of stay (ALOS) of Medicaid patients for all patients and for twenty-one diagnoses selected for closer scrutiny. This analysis employs the concept of expected length of stay (ELOS) for matched patients which is explained fully in the Methodology chapter of this report.

Section 6.3 focuses on the changes in the LOS distribution that may be attributable to the concurrent review activity. This analysis is particularly important because of the lack of sensitivity of ALOS as a measure of changes in the distribution of lengths of stays. Measures of the length of stay distribution used in the analysis are the percent of short stays and the percent of long stays for Medicaid patients. Short stays are defined as the number of patients with stays less than the fifth percentile for matched patients as described in the study methodology. Long stays are defined as the number of patients with stays greater than the seventy-fifth percentile for matched patients.

Section 6.4 of the analysis examines changes in the diagnostic mix between the pre-review and post-review time periods for the concurrent review and comparison hospitals. Section 6.5 considers the number of discharges and the number of patient days as the dependent variables. Because of the lack of any appropriate denominator data specific to individual hospitals as the unit of analysis, it was impossible to examine changes in the number of discharges per 1000 eligible population or the number of patient days of care per 1000 eligible population. Therefore, the analysis of discharges and patient days is severely

limited in terms of any inferences that may be drawn about the impact of concurrent review activity on these aspects of hospital utilization.

Section 6.6 of the analysis briefly examines three types of patient discharges that were excluded from the main analysis. The excluded patient categories are transfers, deaths, and patients with stays over 100 days. These sets of patients are examined for changes that occurred between the pre-review and post-review time periods and between concurrent review and comparison hospitals.

Section 6.7 of the Medicaid utilization analysis investiages the relationships between changes in the length of stay and the severity levels of the disease as measured by the "staging index" for concurrent review hospitals and comparison hospitals in the pre-review and post-review time periods. The stage of disease is used as a stratification variable in an attempt to control more fully for the medical characteristics of the patient's condition and, thus, obtain as homogeneous a patient population as possible in order to examine the effects of concurrent review activity on the length of patient stay.

6.2 AVERAGE LENGTH OF STAY ANALYSIS

The primary purpose of the analysis of average length of stay is to evaluate the effectiveness of concurrent review activity in changing the ALOS of Medicaid hospital patients.

The four major hypotheses to be tested about the relationship of PSRO concurrent review activity and changes in ALOS for Medicaid patients are identical to the hypotheses presented in the Medicare Utilization Analysis and will not be repeated here. The evaluation design and analytical procedures are also the same as those used in the previous analysis.

Before the results of the statistical tests of the hypotheses are given, some basic characteristics of the trends in ALOS for Medicaid patients in the concurrent review and comparison hospitals are described.

6.2.1 Trends in Average Length of Stay

The trends in the Medicaid ALOS for the concurrent review and comparison hospitals presented in Figure 6.1 exhibit important differences from the ALOS trends for Medicare patients. For the Medicare sample, the ALOS for both the concurrent review and comparison hospitals was declining sharply over the eleven quarter time period and the ALOS and ELOS trend lines for each hospital group showed increasing divergence over the course of the eleven-quarter time period included in the study. However, for the Medicaid patients, both of the major characteristics of the trends in ALOS and ELOS for Medicare were reversed. ALOS for the concurrent review and comparison hospitals did not exhibit a sharply declining trend over the time period. The ALOS between the first quarter of 1974 and the third quarter of 1976 dropped by only 0.37 days compared with the almost one day decrease observed for Medicare. In addition the ALOS and ELOS for Medicaid were obviously converging over the time period. By the third quarter of 1976 the ALOS and ELOS for each hospital group were less than one-tenth of a day apart. Thus, the Medicaid patients were becoming more and more similar to the general matched patient population in the ALOS where the Medicare patients were becoming increasingly different in their length of stay behavior. Figure 6.2 plots the ALOS - ELOS values for the time period for concurrent review and comparison hospitals. Toward the end of the time period it can easily be seen that the ALOS - ELOS for both hospital groups approach zero.

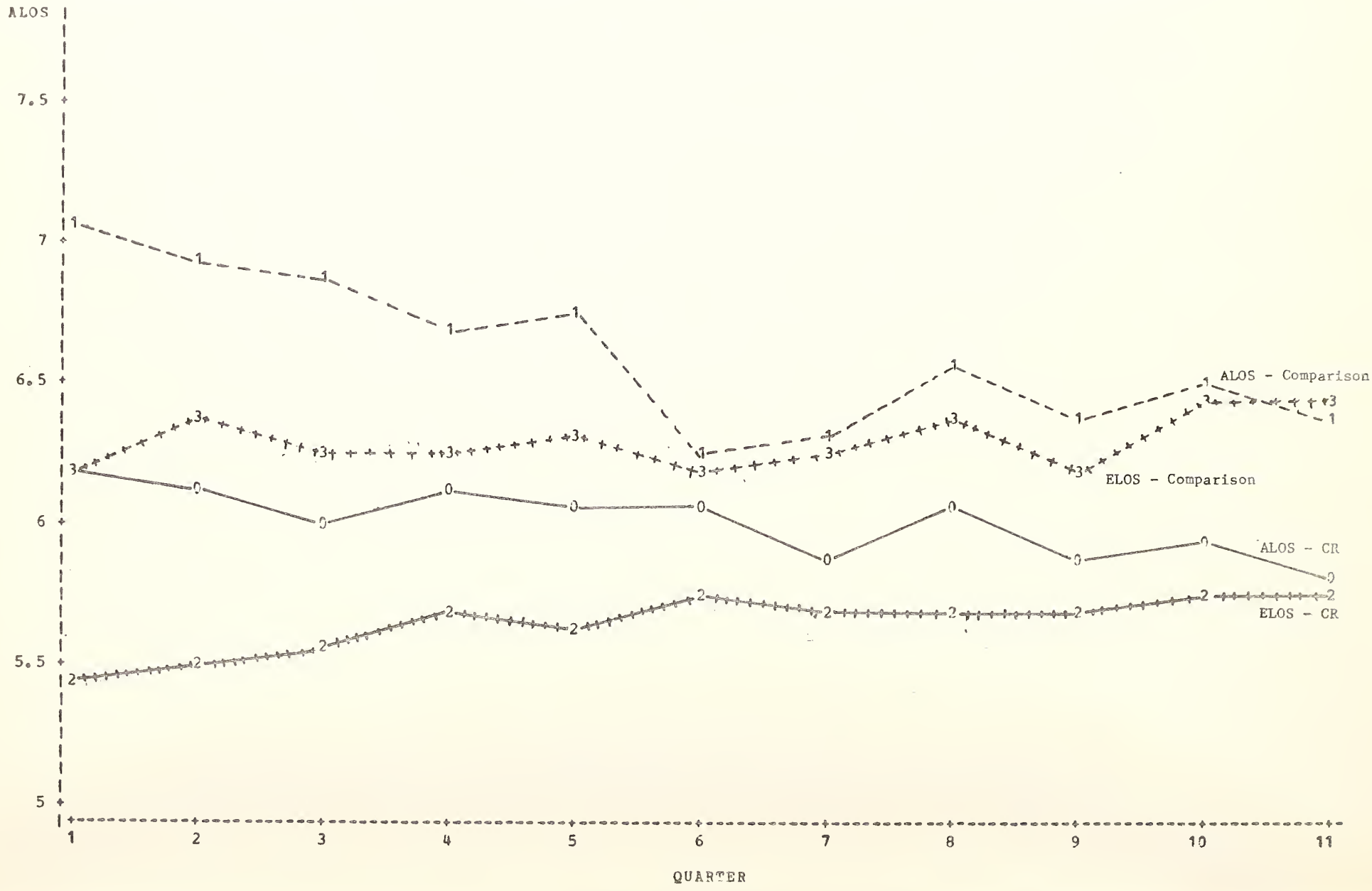
A linear regression analysis was performed using ALOS corrected for ELOS as the dependent varible to determine the value of the slopes of the best fit lines for the concurrent review and comparison hospitals and to test for the

Figure 6.1

ACTUAL (0,1) AND EXPECTED (2,3) LENGTHS OF STAY BY QUARTER
FOR STUDY (0,2) AND COMPARISON (1,3) HOSPITALS --- MEDICAID

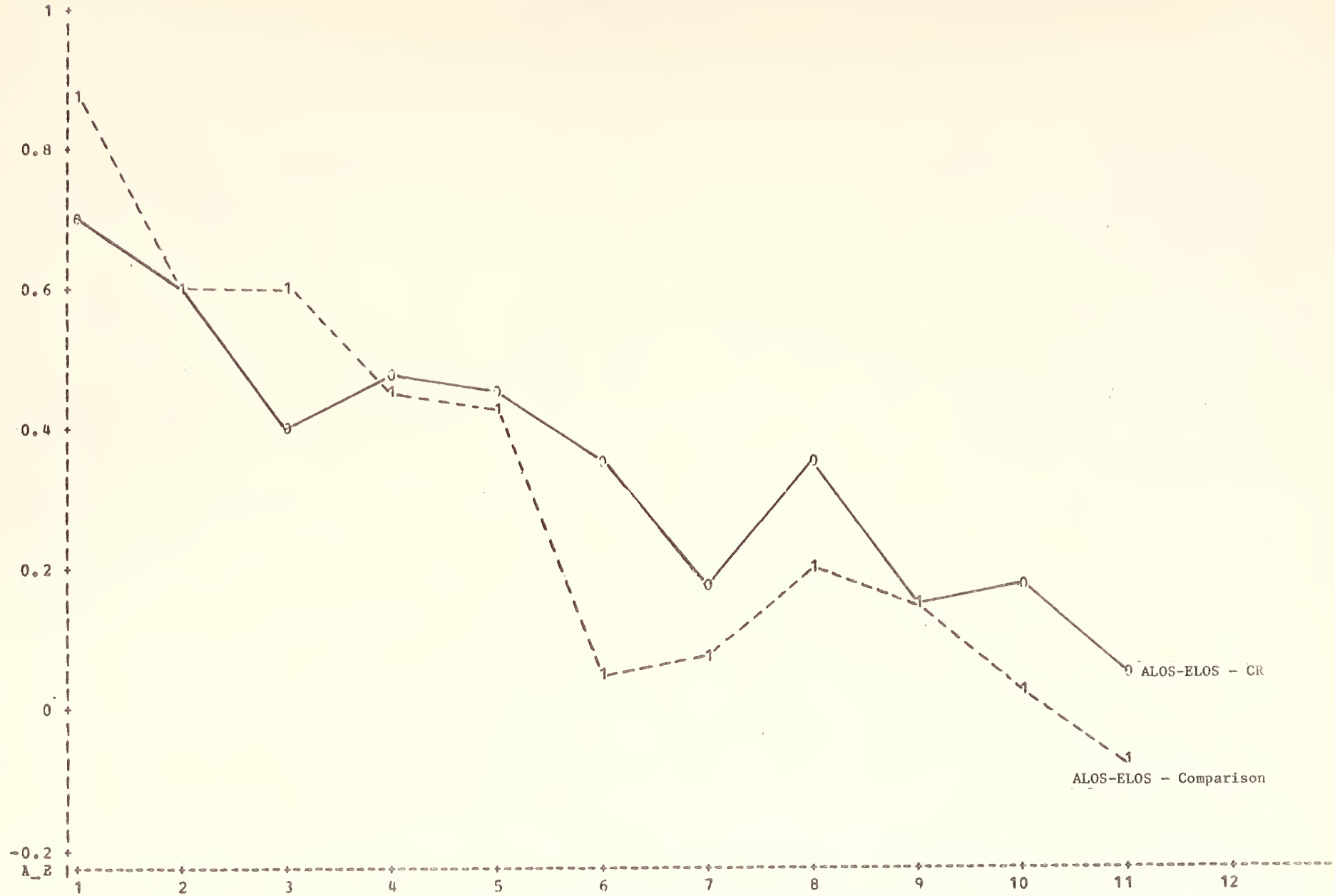
PLOT OF QUARTER*ALOS LEGEND: SYMBOL IS VALUE OF STYPE
PLOT OF QUARTER*ELOS LEGEND: SYMBOL IS VALUE OF STYPE2

QUARTER = STUDY QUARTER: 1-1974/1,...,11-1976/3 ALOS = AVERAGE LENGTH OF STAY ELOS = EXPECTED L.O.S.



ACTUAL MINUS EXPECTED LENGTHS OF STAY BY QUARTER
FOR STUDY (0) AND COMPARISON (1) HOSPITALS --- MEDICAID

PLOT OF QUARTER*A_Z LEGEND: SYMBOL IS VALUE OF STYPE



QUARTER = STUDY QUARTER: 1=1974/1,...,11=1976/3

significance of the differences between the two slopes. The results of the analysis are given in Table 6.1. The comparison hospitals appear to exhibit a more negative slope than the concurrent review hospitals; however, the difference between the slopes of the two hospital groups were only marginally significant. (P = .0865 for ALOS corrected for ELOS, P = .0529 for ALOS - ELOS). Therefore, over the tested time period, ALOS and ALOS - ELOS are declining slightly for the concurrent review and comparison hospitals with the comparison hospitals experience a slightly greater rate of decrease.

In Figure 6.3 the ALOS over the time period is plotted for each hospital cohort according to the start-up dates for binding Title 19 concurrent review. Comparison hospitals experienced a higher ALOS than any hospital cohort over the entire time period. The ALOS for the cohorts B,C, and D, generally fluctuated within $\pm$ .5 day with no discernable trend. Cohort A, however, fluctuated widely and exhibited the largest decrease in ALOS (1.32 days) between the beginning and end of the period of any hospital cohort. Table 6.2 provides the ALOS for concurrent review and comparison hospitals by quarter and for each of the concurrent review hospital cohorts.

TABLE 6.1

TEST OF DIFFERENCES IN SLOPES OF ALOS (CORRECTED FOR ELOS)
AND ALOS-ELOS BETWEEN CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICAID

DEPENDENT VARIABLE	NUMBER OF OBSERVATIONS	SLOPE CR HOSPITALS	SLOPE COMPARISON HOSPITALS	DIFFERENCES IN SLOPE COMPARISON-CR	t-VALUE	P-VALUE
ALOS	11	-0.061	-0.087	-0.026	-1.82	0.0865
ALOS-ELOS	11	-0.057	-0.085	-0.028	-2.07	0.0529

Figure 6.3

OBSERVED LENGTH OF STAY BY QUARTER FOR HOSPITAL MEDICAID REVIEW COHORTS
C.R. START DATES: 4-1974.4, 6-1975.2, 7-1975.3, 8-1975.4/COMPARISONS: 0

PLOT OF QUARTER*ALOS LEGEND: SYMBOL IS VALUE OF QTR19

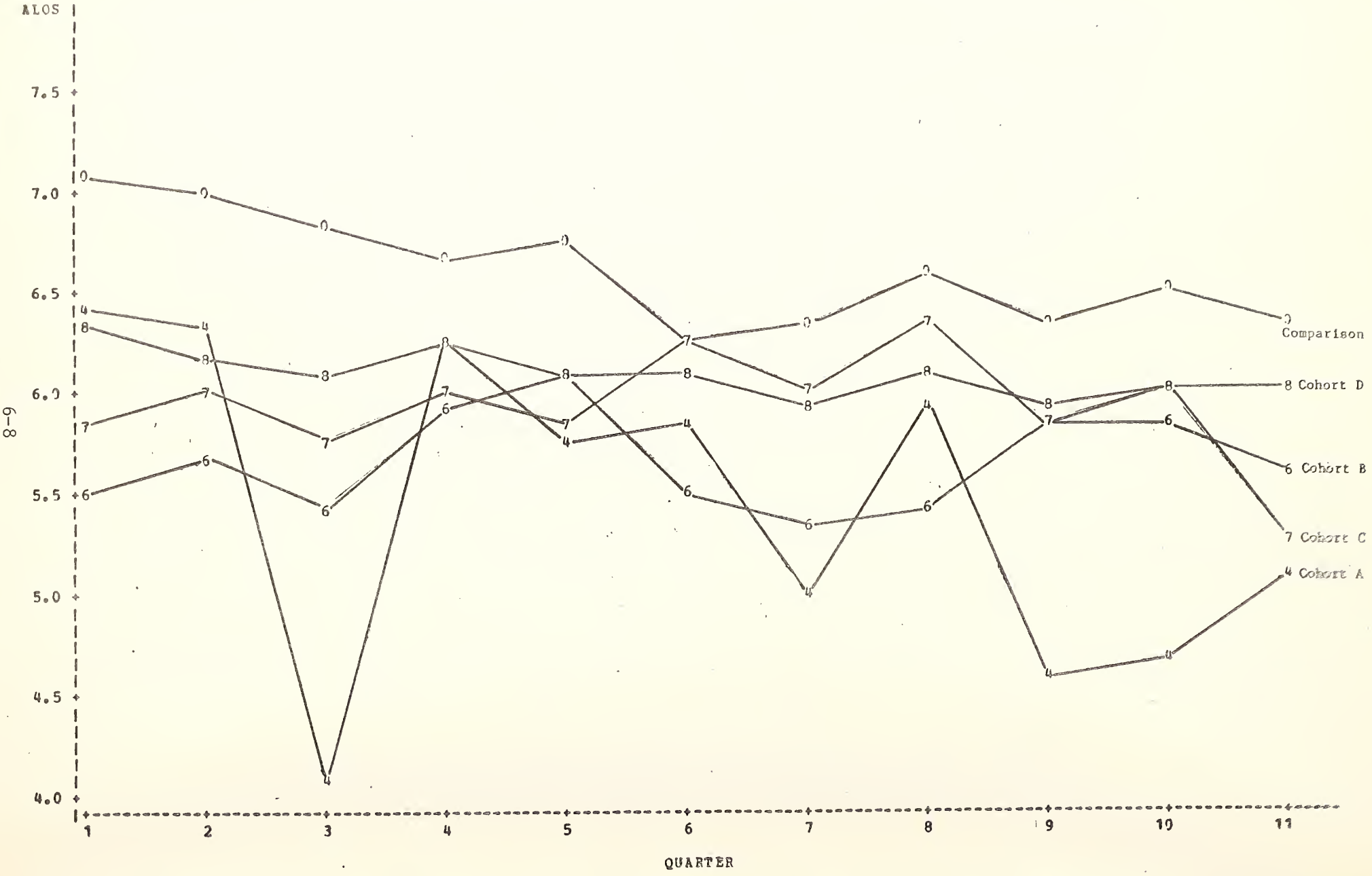


TABLE 6.2

ALOS BY QUARTER FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS AND BY START-UP DATE OF BINDING TITLE 18 REVIEW: MEDICAID

HOSPITAL GROUP \ QUARTER	1974				1975				1976		
	1	2	3	4	1	2	3	4	1	2	3
CONCURRENT REVIEW HOSPITALS COHORT A: 4TH QTR 74 REVIEW START	6.38	6.32	4.12	6.26	5.74	5.80	5.96	6.06	4.57	4.70	5.06
COHORT B: 2ND QTR 75 REVIEW START	5.47	5.69	5.41	5.93	6.08	5.50	5.97	6.30	5.82	5.86	5.58
COHORT C: 3RD QTR 75 REVIEW START	5.84	5.96	5.79	6.00	5.87	6.24	5.34	5.40	5.84	6.00	5.28
COHORT D: 4TH QTR 75 REVIEW START	6.29	6.20	6.12	6.21	6.11	6.11	4.99	5.88	5.89	5.98	5.96
ALL CR HOSPITALS	6.16	6.12	5.99	6.15	6.06	6.09	5.89	6.05	5.86	5.95	5.79
COMPARISON HOSPITALS	7.06	6.96	6.86	6.67	6.72	6.27	6.30	6.56	6.36	6.47	6.37

6.2.2 Pre - Post Analysis of ALOS

When the changes in the average length of stay between the pre-review and post-review periods for concurrent review and comparison hospitals were examined, it was found that the ALOS declined somewhat more for the comparison hospitals (-.55 day) than for the concurrent review hospitals (-.22 day). When the change in ALOS - ELOS were examined a similar pattern was found. The difference between the decreases in the ALOS for the comparison hospitals and the concurrent review hospitals was approximently one-third of a day in favor of the comparison group and one-fifth of a day for the ALOS - ELOS variable. Table 6.3 presents the change measures pre and post for the ALOS and ALOS - ELOS variables for both hospital groups.

Table 6.4 shows the number and percent of hospitals by direction of change in the ALOS and ALOS - ELOS measures for the concurrent review and comparison groups. Of the 77 concurrent review hospitals, 46 (59.7%) experienced decreases in the ALOS between the pre-review and post-review time periods while 62.8% of the 51 comparison hospitals decreased their ALOS. Therefore, a somewhat smaller proportion of the concurrent review hospitals reduced ALOS in their institution than was true for the comparison hospital group. A similar finding is made when the ALOS-ELOS measure was used. However, a Chi-Square test shows that there is no statistically significant interaction between pre-post changes in average length of stay and hospital type (X^2 = .116 for ALOS and X^2 = 0.087 for ALOS - ELOS).

TABLE 6.3

CHANGE IN ALOS FOR
CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICAID

HOSPITAL GROUP	PRE-REVIEW (1st,2nd,3rd Qrt 1974)			POST REVIEW (1st,2nd,3rd Qtr 1976)			DIFFERENCE	
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	$(ALOS)_{POST} - (ALOS)_{PRE}$	$(ALOS-ELOS)_{POST} - (ALOS-ELOS)_{PRE}$
CONCURRENT REVIEW HOSPITALS	6.09	5.52	0.57 ($\hat{\beta}_0$)	5.87	5.74	0.13	-0.22	-0.44 ($\hat{\beta}_2$)
COMPARISON HOSPITALS	6.95	6.27	0.68 ($\hat{\beta}_1+\hat{\beta}_2$)	6.40	6.36	0.04	-0.55	-0.64 ($\beta_2+\beta_3$)
NET DIFFERENCE (COMPARISON-CONCURRENT REVIEW)	+.86	+.75	+.11 ($\hat{\beta}_1$)	+.53	+.62	-.09	-.33	-.20 ($\hat{\beta}_3$)

TABLE 6.4

NUMBER AND PERCENT OF HOSPITALS BY DIRECTION OF CHANGE IN ALOS AND ALOS - ELOS FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICAID

DIRECTION OF CHANGE / HOSPITAL GROUP		(ALOS) POST - (ALOS) PRE			TOTAL
		<0	=0	>0	
CONCURRENT REVIEW	N	46	1	30	77
	%	59.7	1.3	39.0	100.0
COMPARISON	N	32	1	18	51
	%	62.8	2.0	35.2	100
TOTAL	N	78	2	48	128
	%	60.9	1.6	37.5	100.00

CHI-SQUARE = 0.116, P = 0.7330, DF = 1. (For 2 x 2 table with 0 and >0 categories combined.)

DIRECTION OF CHANGE / HOSPITAL GROUP		(ALOS-ELOS) POST - (ALOS-ELOS) PRE			TOTAL
		<0	=0	>0	
CONCURRENT REVIEW	N	54	0	23	77
	%	70.1	0.0	29.9	100
COMPARISON	N	37	0	14	51
	%	72.5	0.0	27.4	100.0
TOTAL	N	91	0	37	128
	%	71.1	0.0	28.9	100.0

CHI-SQUARE = 0.087, P = 0.7676, DF = 1. (For 2 x 2 table with 0 and >0 categories combined.)

The statistical significance of the changes in the ALOS and ALOS - ELOS dependent variables was tested using the linear regression model described in detail in the methodology chapter of this report. The regression analysis results for all Medicaid patients are given in Table 6.5 The estimated regression coefficient for the ELOS variable in the ALOS equation is 0.98407 with a standard error of 0.00988, indicating, as in the Medicare analysis, that the ELOS is acting as a reliable adjustment index. The value of the constant term is somewhat greater than zero (0.66039)with a standard error of(0.06681), which indicates the relationship between ALOS and ELOS is not as close to the 1 : 1 relationship observed for the Medicare sample. However, even with this difference, two specifications of the regression equation result in almost identical estimates for the remaining variables.

The ALOS specification yields a 0.12 ($\hat{\beta}_1$) coefficient for the STYPE variable compared with the 0.11 coefficient from the ALOS - ELOS equation. The positive sign reflects that ALOS was, on the average, .12 days higher in the comparison hospitals than with concurrent review hospitals during the three quarter pre-review period. However the low t-value and its associated probability indicate that this difference was not statistically significant at the $P < .05$ level.

Identical estimates are obtained from ALOS and ALOS - ELOS specification for the time coefficient ($\hat{\beta}_2 = -0.45$), indicating that ALOS declined significantly ($P = .0001$) on the average by 0.45 days between the pre-review and post-review periods for the concurrent review hospitals. The decrease in ALOS for the comparison hospitals was -0.65 days ($\hat{B}_2 + \hat{B}_3 = -0.45 - 0.20 = -0.65$). Therefore, while ALOS decreased for the concurrent review hospitals, it decreased, on the average of 0.20 ($\hat{\beta}_3 = -0.20$) more in the comparison hospitals. This one-fifth of a day difference in the ALOS pre-post changes between the two hospital groups was statistically significant ($p = .0231$) and is therefore a reliable

TABLE 6.5

Analysis Results of the Relationship Between

Average Length of Stay, Expected Length of Stay, Hospital Review Type, and Time

MEDICAID

Dependent Variable: ALOS FORM: $ALOS = B_0 + B_1\ STYPE + B_2\ TIME + B_3\ (STYPE \cdot TIME) + B_4\ ELOS + \epsilon$

NUMBER OF OBSERVATIONS = 8568
DEGREES OF FREEDOM = 8563

PARAMETER	ESTIMATE	T FOR HO: PARAMETER = 0	PR > |T|	STD ERROR OF ESTIMATE
B_0 CONSTANT	0.66039338	9.88	0.0001	0.06681073
B_4 ELOS	0.98406858	99.60	0.0001	0.00988028
B_1 STYPE	0.11825910	1.75	0.0794	0.06740960
B_2 TIME	-0.45124368	-8.54	0.0001	0.05283282
B_3 STYPE·TIME	-0.20029951	-2.27	0.0231	0.08812600

Dependent Variable: ALOS - ELOS FORM: $ALOS = B_0 + B_1\ STYPE + B_2\ TIME + B_3\ (STYPE \cdot TIME) + \epsilon$

NUMBER OF OBSERVATIONS = 8568
DEGREES OF FREEDOM = 8564

PARAMETER	ESTIMATE	T FOR HO: PARAMETER = 0	PR > |T|	STD ERROR OF ESTIMATE
B_0 CONSTANT	0.57243970	14.84	0.0001	0.03857817
B_1 STYPE	0.10624536	1.59	0.1129	0.06700600
B_2 TIME	-0.45484126	-8.62	0.0001	0.05279261
B_3 STYPE·TIME	-0.19831878	-2.25	0.0245	0.08812880

estimate of the net difference in the change in ALOS between the hospital groups. Thus it appears that the concurrent review activities of the PSRO were associated with declining ALOS in the concurrent review hospitals, but that the comparison hospitals were somewhat more successful in decreasing lengths of stay than were the institutions undergoing concurrent review. An additional regression model was run to test whether these observed differences in ALOS (and ALOS-ELOS) may have resulted from bias in the sampling plan leading to an overrepresentation of certain types of hospitals in the comparison group. The results of that regression analysis which controlled for selected hospital and catchment area characteristics (Table 6.10I, bottom line) were consistent with the findings shown in Table 6.5.

Therefore, the principal finding of the analysis is that there is sufficient evidence to reject the hypothesis that the changes in the average length of stay between the pre-review and post-review periods for Medicaid patients are equal for PSRO concurrent review and comparison hospitals. However, the direction of the relationship runs counter to what might have been expected based on the intent of the PSRO program with regard to length of stay. Although the ALOS in both the PSRO concurrent and comparison hospitals declined significantly, the comparison hospitals exhibited a greater decrease in ALOS for Medicaid patients than did the PSRO concurrent review hospitals by .20 days. The opposite was true for the Medicare where the PSRO concurrent review hospitals out-performed the comparison hospitals in reducing ALOS by .23 days.

6.2.3 Diagnostic Specific Pre-Review, Post-Review Analysis of ALOS

The twenty-two diagnosis groups were examined to determine what changes in the ALOS between the concurrent review hospitals and comparison hospitals took place for Medicaid patients over the time period included in the study.

Tables 6.6 and 6.7 present the descriptive findings of the diagnosis group analysis. The tables include measures of ALOS, ELOS and ALOS-ELOS for the pre-review and post-review periods for both groups of hospitals. The post minus pre differences for the ALOS and ALOS-ELOS measures are also given.

Of the twenty-two diagnosis groups, twenty showed a decrease in either the ALOS or ALOS-ELOS measure for the concurrent review hospitals between the pre-review and post-review periods. Only Urinary Tract Infection (DX #4) Hypertrophy of Tonsils and Adenoids (DX #17) showed increases in the ALOS and ALOS-ELOS measures for the concurrent review hospitals, and in both cases the observed increase was relatively small. Thirteen groups experienced a decline in either ALOS or ALOS-ELOS of one half day or more for the concurrent review hospitals. Those thirteen diagnosis groups are listed below:

Diagnosis Group	ALOS Decrease	ALOS-ELOS Decrease
Hypertension	-.97	-1.03
Congestive Heart Failur Pulmonary Edema	-.38	-.69
Ulcer Stomach,Duodenal Peptic, Gastrojejunal	-.41	-1.04
Cholecystitis/Choletithiasis	-1.35	-1.34
Hyperplasia Prostate	-1.18	-1.30
Intervertebral Disc, Displacement	-.83	-1.23
Cerebrovascular Disease	-3.99	-3.17
Chronic Ischemic Heart Disease	-1.58	-1.51
Acute Myocardial Infarction	-2.72	-2.09
Diabetes with & without Acidosis	-.41	-.64
Maglignant Neoplasm of Breast	-.31	-1.12
Fracture of Femur	-2.83	-3.20
Cataract	-.49	-.58

TABLE 6.6

CHANGE IN ALOS BY DIAGNOSIS GROUP
FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICAID

DIAGNOSTIC GROUP AND HOSPITAL GROUP	PRE-REVIEW ALOS	PRE-REVIEW ELOS	PRE-REVIEW ALOS-ELOS	POST-REVIEW ALOS	POST-REVIEW ELOS	POST-REVIEW ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
DX GROUP: 1 CR HOSPS	9.03106	7.46988	1.56118	8.06176	7.53033	0.531435	-0.9693	-1.0297
DX GROUP: 1 CONTROL	9.12127	7.62301	1.49826	9.02478	7.88286	1.14193	-0.0965	-0.3563
DX GROUP: 2 CR HOSPS	7.15552	6.38324	0.772281	6.96485	6.55169	0.313158	-0.2907	-0.4591
DX GROUP: 2 CONTROL	8.14352	6.83962	1.3039	7.26748	6.81709	0.450391	-0.8760	-0.8535
DX GROUP: 3 CR HOSPS	10.7338	10.2029	0.53091	10.3533	10.51	-.156718	-0.3806	-0.6876
DX GROUP: 3 CONTROL	10.7119	10.4096	0.302289	10.7016	10.856	-.154421	-0.0103	-0.4567
DX GROUP: 4 CR HOSPS	5.45212	5.66474	-.212612	5.51258	5.37436	0.138218	0.0605	0.3508
DX GROUP: 4 CONTROL	6.64582	5.56899	1.07683	5.25236	5.41047	-.158112	-1.3935	-1.2349
DX GROUP: 5 CR HOSPS	9.69783	7.98369	1.71414	9.28886	8.61484	0.674014	-0.4090	-1.0401
DX GROUP: 5 CONTROL	10.6558	8.92228	1.73354	8.7409	9.13144	-.390532	-1.9149	-2.1241
DX GROUP: 6 CR HOSPS	10.1361	8.42204	1.71409	8.79115	8.42047	0.370679	-1.3450	-1.3434
DX GROUP: 6 CONTROL	9.96019	9.12569	0.834498	10.338	9.02435	1.31362	0.3778	0.4791
DX GROUP: 7 CR HOSPS	3.96308	3.32823	0.634851	4.04129	3.76689	0.274394	0.0782	-0.3605
DX GROUP: 7 CONTROL	4.27659	3.67869	0.597899	3.59333	3.48888	0.104456	-0.6833	-0.4934
DX GROUP: 8 CR HOSPS	10.4891	8.42718	2.0619	9.31033	8.55162	0.758709	-1.1788	-1.3032
DX GROUP: 8 CONTROL	9.27344	8.95284	0.320593	11.134	9.3113	1.82273	1.8606	1.5021
DX GROUP: 9 CR HOSPS	11.374	10.6577	0.716283	10.5423	11.0584	-0.51617	-0.8317	-1.2325
DX GROUP: 9 CONTROL	9.51302	10.7953	-1.28229	9.5136	10.6674	-1.1538	0.0006	0.1285
DX GROUP: 10 CR HOSPS	5.50364	5.33204	0..71602	5.60689	5.50143	0.105463	0.1033	-0.0661
DX GROUP: 10 CONTROL	6.42623	6.04624	0.37999	5.19488	5.65879	-.463909	-1.2313	-0.8439
DX GROUP: 11 CR HOSPS	13.7223	11.2813	2.44105	9.73622	10.467	-.730791	-3.9861	-3.1718
DX GROUP: 11 CONTROL	9.8876	10.5161	-.628525	10.4516	10.6215	-.169857	0.5640	0.4587

TABLE 6.6
(continued)

CHANGE IN ALOS BY DIAGNOSIS GROUP
FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICAID

DIAGNOSTIC GROUP AND HOSPITAL GROUP		PRE-REVIEW ALOS	PRE-REVIEW ELOS	PRE-REVIEW ALOS-ELOS	POST-REVIEW ALOS	POST-REVIEW ELOS	POST-REVIEW ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
DX GROUP: 12	CR HOSPS	9.5956	9.53977	1.05584	8.01964	8.4782	-0.45856	-1.5760	-1.5144
DX GROUP: 12	CONTROL	9.13452	8.38431	0.750212	7.49466	8.39728	-.902616	-1.6399	-1.6528
DX GROUP: 13	CR HOSPS	18.6012	16.8283	1.77291	15.8772	16.1899	-.312678	-2.7240	-2.0856
DX GROUP: 13	CONTROL	16.2904	16.7619	-.471436	15.3308	16.7271	-1.39631	-0.9597	-0.9249
DX GROUP: 14	CR HOSPS	9.67506	8.27376	1.4013	9.26744	8.50913	0.758306	-0.4076	-0.6430
DX GROUP: 14	CONTROL	11.0482	9.09079	1.95742	8.57988	8.86317	-.283294	-2.4683	-2.2407
DX GROUP: 15	CR HOSPS	11.4964	9.89046	1.60589	11.188	10.6986	0.489431	-0.3084	-1.1165
DX GROUP: 15	CONTROL	12.7016	12.4031	0.298462	11.9526	10.1806	1.77202	1.2510	1.4736
DX GROUP: 16	CR HOSPS	4.12831	3.80642	0.321893	4.02065	3.88492	0.135729	-0.1077	-0.1862
DX GROUP: 16	CONTROL	4.00052	3.87252	0.128001	3.98045	4.1071	-.126654	-0.0201	-0.2547
DX GROUP: 17	CR HOSPS	1.86815	1.90306	-.034904	1.91347	1.90689	.0065823	0.0453	0.0415
DX GROUP: 17	CONTROL	1.94212	1.85229	.0898287	1.91295	1.85163	.0613143	-0.0292	-0.0285
DX GROUP: 18	CR HOSPS	24.4793	20.1589	4.32047	21.6538	20.5333	1.12052	-2.8256	-3.2000
DX GROUP: 18	CONTROL	20.2821	22.2349	-1.95282	20.861	22.0617	-1.20073	0.5789	0.7521
DX GROUP: 19	CR HOSPS	5.91276	4.483	1.42977	5.42092	4.57044	0.850476	-0.4918	-0.5793
DX GROUP: 19	CONTROL	5.78137	4.89877	0.882602	4.2297	4.82967	-.599971	-1.5517	-1.4826
DX GROUP: 20	CR HOSPS	8.72059	10.6	-1.87944	9.58822	11.9418	-2.35359	0.8676	-0.4741
DX GROUP: 20	CONTROL	11.7363	11.1278	0.608494	11.348	12.5442	-1.19626	-0.3883	-1.8048
DX GROUP: 21	CR HOSPS	5.97552	5.64923	0.326292	5.89526	5.81574	.0795229	-0.0803	-0.2468
DX GROUP: 21	CONTROL	6.81385	5.86522	0.948624	6.37208	5.89346	0.478622	-0.4418	-0.4700
DX GROUP: 22	CR HOSPS	6.29802	5.64368	0.654334	6.06384	5.89195	0.171889	-0.2342	-0.4824
DX GROUP: 22	CONTROL	7.1028	6.33207	0.770728	6.50153	6.3963	0.10523	-0.6013	-0.6655

TABLE 6.7

Differences in ALOS and ALOS-ELOS Pre-Post Changes Between Concurrent Review and Comparison Hospitals: MEDICAID

Dx #	Diagnosis Group	ALOS			ALOS-ELOS		
		Concurrent Review	Comparison	Difference (Comparison-CR)	Concurrent Review	Comparison	Difference (Comparison-CR)
1	Hypertension	- .97	- .10	+ .87	-1.03	- .36	+1.27
2.	Pneumonia	- .29	- .88	- .59	- .46	- .85	- .39
3	Congestive Heart Failure Pulmonary Edema	- .38	- .01	+ .37	+ .69	- .46	+.23
4	Urinary Tract Infection	+ .06	-1.39	-1.45	+ .35	-1.23	-1.58
5	Ulcer Stomach, Duodenal Peptic, Gastrojejunal	- .41	-1.91	-1.50	-1.04	-2.12	-1.08
6	Cholecystitis/Choletithiasis	-1.35	.38	1.73	-1.34	+ .48	-1.86
7	Inguinal Hernia without Obstruction	+ .08	- .68	- .76	- .36	- .49	- .13
8	Hyperplasia Prostate	-1.18	+1.86	+3.04	-1.30	+1.50	+2.80
9	Intervertebral Disc, Displacement	- .83	+ .0006	+ .83	-1.23	+ .13	+1.36
10	Complications & Adverse Reactions	+ .10	-1.23	-1.33	- .07	- .84	- .77
11	Cerebrovascular Disease	-3.99	+ .56	+4.55	-3.17	+ .46	+3.63
12	Chronic Ischemic Heart Disease	-1.58	-1.64	- .06	-1.51	-1.65	- .14
13	Acute Myocardial Infarction	-2.72	-0.96	+1.76	-2.09	- .92	+1.17
14	Diabetes w/ & w/9 Acidosis	- .41	-2.47	-2.06	- .64	-2.24	-1.60
15	Malignant Neoplasm of Breast	- .31	+1.25	+1.56	-1.12	+1.47	+2.59
16	Delivery w & w/o Complications	- .11	- .02	+ .09	- .19	- .25	- .06

TABLE 6.7

(continued)

Dx #	Diagnosis Group	ALOS			ALOS-ELOS		
		Concurrent Review	Comparison	Difference (Comparison-CR)	Concurrent Review	Comparison	Difference (Comparison-CR)
17	Hypertrophy Toncils and Adenoids	+ .05	- .03	- .08	+ .04	- .03	- .07
18	Fracture of Femur	-2.83	+ .58	+3.41	03.20	+ .75	+3.95
19	Cataract	- .49	-1.55	-1.06	- .58	-1.48	- .90
20	Neuroses	+ .87	- .39	-1.26	- .47	-1.80	-1.33
21	Appendicitis	- .08	- .44	- .36	- .25	- .47	- .22
22	Other	- .23	- .60	- .37	- .48	- .67	- .19

When the changes in ALOS for the concurrent review hospitals are compared to the changes in ALOS for the comparison hospitals, ten diagnosis groups experienced greater decreases in ALOS for the review hospitals than for the non-review hospitals. When the ALOS-ELOS measure is considered, in only eight of the twenty-two diagnosis groups did the concurrent review hospitals outperform the comparison hospitals in reducing length of stay. Table 6.7 summarizes the differences in ALOS and ALOS-ELOS pre-post changes between concurrent review hospitals and comparison hospitals.

It is apparent that four diagnosis groups in the concurrent review hospitals experienced major decreases in ALOS when compared to the non-CR hospitals: Cerebrovascular Disease (DX #11), Fracture of Femur (DX #18), Acute Myocardial Infraction (DX #13), and Hyperplasia of the Prostate (DX #8). In each of these diagnosis groups the concurrent review hospitals experienced decreases in ALOS while the ALOS in the comparison hospitals went up between the pre and post periods. Although the changes in ALOS were relatively large for these diagnosis groups, the number of patients in each of these categories was not large. (The diagnostic mix analysis as discussed in section 6.4 of this chapter.) The largest number of Medicaid patients occurred for Delivery (DX #16), Hypertrophy Tonsils and Adenoids (DX #17), and the Other category (DX #22). For the first two groups, the net change between concurrent review and comparison hospitals was less than one-tenth of a day. For the "Other" diagnosis group (DX #22, which contained almost two-thirds of the Medicaid patients), the net change was -.37 days in ALOS, indicating that the comparison hospitals were

more successful in reducing ALOS for this miscellaneous category than were the concurrent review hospitals.

A regression analysis was used to test the statistical significance of the relationships between changes in the length of stay, the presence or absence of concurrent review, the time period, and the interaction of hospital type and time for the twenty-two diagnostic categories. The results of this analysis are presented in Table 6.8. Inspection of the t values and their associated probabilities for the cross product term of STYPE·TIME shows that the change in length of stay for the concurrent review hospitals versus the comparison hospitals was significant at the $p<.05$ level for four of the diagnosis groups.

The changes in ALOS adjusted for ELOS in the concurrent review hospitals for Cholecystitis/Choletithiasis diagnosis group (DX # 6) and Cerebrovascular Disease (DX #11) showed statistically significant decreases when compared with the comparison hospital group. This is reflected in the positive sign of the β_3 regression coefficient. However, for the diagnosis groups Urinary Tract Infection (DX # 4) and Diabetes (DX # 14), the comparison hospitals did significantly better than the concurrent hospitals in reducing the ALOS for these patients. Based on these findings, there appears to be sufficient evidence in only four diagnosis groups to reject the diagnosis group specific null hypothesis that changes in ALOS are equal for concurrent review and comparison hospitals. However, because of the mixed directions of differences for these four diagnoses, interpretation of these results must be made cautiously. More specific evidence is required before it would be possible to account for these changes in terms of the PSRO concurrent review activity.

TABLE 6.8

ALOS Regression Analysis by Diagnosis Group: MEDICAID

Dependent Variable: ALOS Form: $ALOS = \beta_0 + \beta_1\ STYPE + \beta_2\ TIME + \beta_3\ (STYPE \cdot TIME) + \beta_4\ ELOS + \varepsilon$

Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-Value	P	Estimate	t-Value	P		
1. Hypertension	-1.0337	-1.76	.0796	.6747	.74	.4594	358	353
2. Pneumonia	.4543	-1.74	.0822	- .4066	-1.00	.3185	547	542
3. Congestive Heart Failure	- .7820	- .94	.3504	.2096	.15	.8799	307	302
4. Urinary Tract Infection	.3019	.82	.4105	-1.5637	-2.47	.0138	433	428
5. Ulcer Stomach	-1.090	-1.87	.0627	-1.0639	-1.09	2746	394	389
6. Cholecystitis/Choletithiasis	-1.3613	-3.62	.0003	1.8470	2.89	.0041	512	507
7. Inguinal Hernia	- .4699	-2.21	.0279	.0131	.04	.9682	402	397
8. Hyperplasia Prostate	-1.2803	-1.21	.2284	2.7366	1.67	.0979	131	126
9. Disc Displacement	-1.3167	-1.55	.1220	1.4236	1.17	.2447	316	311
10. Complications & Adverse Reactions	- .0413	- .11	.9105	- .8590	-1.43	.1545	540	535
11. Cerebrovascular Disease	-3.2982	-2.63	.0090	3.7367	2.10	.0367	253	248
12. Chronic Ischemic Heart Disease	-1.5116	-3.06	.0023	- .1673	.23	.8152	410	405

TABLE 6.8

ALOS Regression Analysis by Diagnosis Group: MEDICAID
continued

Dependent Variable: ALOS Form: $ALOS = \beta_0 + \beta_1 STYPE + \beta_2 TIME + \beta_3 (STYPE \cdot TIME) + \beta_4 ELOS + \varepsilon$

Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$				
	Estimate	t-Value	P	Estimate	t-Value	P	OBS.	D.F.
13. Acute Myocardial Infarction	-2.2464	-1.73	.0850	1.2745	.72	.4740	224	219
14. Diabetes	- .6261	-1.39	.1637	-1.6471	-2.33	.0204	499	494
15. Malignant Neoplasm of Breast	-1.2113	- .92	.3610	2.6973	1.36	.1772	171	166
16. Delivery	- .1850	-2.92	.0036	- .0736	- .65	.5178	575	570
17. Hypertrophy of Tonsils and Adenoids	.0399	.84	.4023	- .0667	0 .71	4769	573	568
18. Fracture of Femur	-3.3635	-1.07	.2878	4.1012	.84	.3998	157	152
19. Cataract	- .6477	-1.61	.1083	- .7952	-1.16	.2470	216	211
20. Neuroses	- .1002	- .16	.8718	-1.3331	-1.39	.1643	441	436
21. Appendicitis	- .2379	- .72	.4739	- .2366	- .41	.6803	372	367
22. Other	- .4881	-4.92	.0001	- .1775	-1.09	.2777	737	732

The coefficients of the TIME term in the regressions, however, do show that six diagnosis groups had statistically significant decreases in ALOS adjusted for ELOS for the Medicaid patients in the concurrent review hospitals. These diagnosis groups are listed below:

DX #	Diagnosis Group	Significance Level for ALOS Decrease in Concurrent Review Hospitals
6	Cholecystitis/Choletithiasis	.0003
7	Inguinal Hernia	.0279
11	Cerebrovascular Disease	.0090
12	Chronic Ischemic Heart Disease	.0023
16	Delivery	.0036
22	Other	.0001

Essentially the same results were obtained using ALOS-ELOS as the dependent variable in the diagnosis group specific analysis.

Given the results of the analysis for all diagnosis groups combined and for the individual groups, it may be concluded that the PSRO activity did not have the intended effect of reducing hospital average length of stay in concurrent hospitals more than would have otherwise been expected. In fact, the comparison hospitals were more successful in reducing average length of stay than the concurrent review hospitals. Although the decrease in ALOS in concurrent review hospitals was significant for some diagnosis groups, the results were mixed when the concurrent review hospitals were compared to the comparison hospitals, with some diagnoses exhibiting significant net reductions and other net increases in ALOS.

6.2.4 Relationship of ALOS and Selected Hospital and County Characteristics

Based on the literature of the determinants of length of stay and the sampling strata used in the development of the original data base, additional variables were selected for further analysis to investigate whether or not the relationship between ALOS and hospital study type and time could be strengthened by controlling for additional hospital specific and/or county characteristics. The variables selected for this analysis include:

- Short-Term Beds in the Hospital
- Teaching Status of the Hospital
- Short-Term Beds per 1000 County Population
- M.D.'s per 1000 County Population
- Extended Care Beds per 1000 County Population aged 65 and over
- Occupancy Rate of the Hospital

Each of the continuous independent variables were examined in a previous study to indentify breaking points for grouping hospitals for the displays as shown in Tables 6.9A through 6.9F.

Following the same procedure and analyses discussed in the Medicare utilization chapter, the independent effects of these variables (and Hospital Delegation Status) were evaluated in relation to the impact of concurrent review on the various utilization measures. The results of the analysis for the ALOS dependent variables are given in Tables 6.10A through 6.10F.

It can be seen from the results displayed in Table 6.10A that large ($\geq$200 beds) PSRO concurrent review hospitals, large comparison hospitals and small PSRO concurrent review and comparison hospitals all experienced significant reductions in ALOS. The decreases in ALOS experienced by comparison hospitals were larger than the decreases experienced by PSRO concurrent review hospitals for both hospital size categories; however, the difference was statistically significant only for the small hospital size category ($\hat{\beta}_6$).

TABLE 6.9A

CHANGE IN AVERAGE LENGTH OF STAY
BY HOSPITAL (BED) SIZE -- MEDICAID

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.R. HOSPITALS NUMBER OF BEDS:								
6-49	6.54588	5.99661	0.549272	4.66419	5.25993	-.595746	-1.8817	-1.1450
50-99	4.95161	4.94582	.0057869	4.66178	5.10439	-.442619	-0.2898	-0.4484
100-199	5.10913	4.96026	0.14887	5.31635	5.21431	0.102045	0.2072	-0.0468
200-299	6.21939	5.70345	0.515943	5.87685	5.81702	.0598253	-0.3425	-0.4561
300-499	6.07999	5.61947	0.460528	5.79528	5.85411	-0.05883	-0.2847	-0.5194
500+	6.70727	5.64672	1.06055	6.68838	6.08288	0.605494	-0.0189	-0.4551
COMPARISON HOSPITALS NUMBER OF BEDS:								
6-49	5.3361	5.32521	.0108847	4.32675	5.29463	-.967878	-1.0093	-0.9788
50-99	5.46789	5.62839	-.160502	5.0059	5.76	-.754096	-0.4620	-0.5936
100-199	6.51807	6.50018	.0178929	5.84312	6.55396	-.710841	-0.6750	-0.7287
200-299	6.02314	6.14886	-0.12572	6.07576	6.3149	-.239138	0.0526	-0.1134
300-499	7.07641	6.48705	0.58936	6.72608	6.65642	.0696626	-0.3503	-0.5197
500+	8.03922	6.20037	1.83884	6.90784	6.19405	0.71379	-1.1314	-1.1251

TABLE 6.9B

CHANGE IN AVERAGE LENGTH OF STAY
BY HOSPITAL TEACHING STATUS: MEDICAID

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.B. HOSPITALS TEACHING STATUS:								
NON-TCH	5.71606	5.43025	0.285806	5.45794	5.61486	-.156927	-0.25812	-0.44273
TEACHNG	6.38561	5.59423	0.791379	6.24898	5.85988	0.389104	-0.13663	-0.40228
COMPARISON HOSPITALS TEACHING STATUS:								
NON-TCH	6.59081	6.14033	0.450484	6.27743	6.32082	-.043383	-0.31338	-0.49387
TEACHNG	7.46472	6.44985	1.01486	6.59461	6.43377	0.160837	-0.87010	-0.85402

CHANGE IN AVERAGE LENGTH OF STAY
BY COUNTY SHORT-TERM BED DENSITY (PER 1000 POPULATION): MEDICAID

	PRE-REVIEW			POST-REVIEW			(ALOS) POST	(ALOS-ELOS) POST
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	- (ALOS) PRE	- (ALOS-ELOS) PRE
C.R. HOSPITALS NONFEDERAL SHORT-TERM BEDS/1000 POP.:								
0-3.4	5.29159	5.43557	-.143979	5.04733	5.43817	-.390836	-0.24426	-0.24686
3.5-4.7	5.33324	5.18021	0.153034	5.18546	5.27442	-.088964	-0.14778	-0.24200
4.8-5.9	6.58634	5.80671	0.779635	6.01801	5.89076	0.127255	-0.56833	-0.65238
6.0+	6.16729	5.38155	0.785745	6.31853	5.90773	0.410798	0.15124	-0.37495
COMPARISON HOSPITALS NONFEDERAL SHORT-TERM BEDS/1000 POP.:								
0-3.4	5.4089	5.80983	-.400925	5.31822	5.97294	-.654722	-0.09069	-0.25380
3.5-4.7	7.28452	5.88922	1.3953	6.71341	6.17291	0.540501	-0.57111	-0.85480
4.8-5.9	6.60799	6.54396	.0640311	6.01875	6.52851	-.509762	-0.58925	-0.57379
6.0+	7.47803	6.68431	0.793721	6.76916	6.68593	.0832321	-0.70887	-0.71049

TABLE 6.9D

CHANGE IN AVERAGE LENGTH OF STAY
BY COUNTY PHYSICIAN DENSITY(PER 1000 POPULATION): MEDICAID

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.R. HOSPITALS NONFEDERAL PHYSICIANS/1000 POP.:								
0-0.9	5.78378	5.73713	.0466502	5.39007	5.76436	-.374289	-0.39371	-0.42094
1.0-1.4	6.27833	5.6264	0.651939	5.77902	5.78563	-.006611	-0.49932	-0.65855
1.5-1.9	6.15706	5.46128	0.695788	5.88115	5.70033	0.180823	-0.27591	-0.51497
2.0+	6.05547	5.34078	0.714684	6.26225	5.71552	0.546733	0.20678	-0.16795
COMPARISON HOSPITALS NONFEDERAL PHYSICIANS/1000 POP.:								
0-0.9	6.48053	6.40755	.0729805	6.06993	6.39948	-.329551	-0.41060	-0.40253
1.0-1.4	6.92979	6.05532	0.874467	6.35696	6.16329	0.193674	-0.57283	-0.68079
1.5-1.9	7.24494	6.78543	0.459512	7.11012	7.04603	.0640929	-0.13481	-0.39542
2.0+	7.23164	6.43785	0.79379	6.57472	6.49405	.0806723	-0.65692	-0.71312

TABLE 6.9E

CHANGE IN AVERAGE LENGTH OF STAY
BY COUNTY E.C. BED DENSITY(PER 1000 POPULATION 65+): MEDICAID

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.R. HOSPITALS E.C. BEDS/1000 AGED 65+:								
NONE	6.13235	5.58367	0.54868	5.81292	5.80827	.0046438	-0.3194	-0.54404
.1-1.4	5.88664	5.40446	0.482131	5.86265	5.59861	0.264039	-0.0240	-0.21814
1.5-2.4	5.93863	5.2836	0.655027	5.77542	5.37978	0.395639	-0.1632	-0.25939
2.5+	6.4555	5.90024	0.555252	6.65365	6.42399	0.229657	0.1982	-0.32560
COMPARISON HOSPITALS E.C. BEDS/1000 AGED 65+:								
NONE	6.78815	6.32524	0.462907	6.29504	6.44301	-.147965	-0.4931	-0.61087
.1-1.4	7.23452	6.59988	0.634643	5.73238	6.08927	-0.35689	-1.5021	-0.99153
1.5-2.4	5.13513	5.21407	-.078937	5.74189	5.89098	-.149092	0.6068	-0.07016
2.5+	7.69539	6.47145	1.22394	6.87329	6.43074	0.442543	-0.8221	-0.78139

TABLE 6.9F

CHANGE IN AVERAGE LENGTH OF STAY
BY HOSPITAL OCCUPANCY RATE -- MEDICAID

	PRE-REVIEW			POST-REVIEW				
	ALOS	ELOS	ALOS-ELOS	ALOS	ELOS	ALOS-ELOS	(ALOS) POST - (ALOS) PRE	(ALOS-ELOS) POST - (ALOS-ELOS) PRE
C.R. HOSPITALS OCCUPANCY RATE:								
0-59%	5.08272	4.96617	0.116559	4.42426	4.61083	-.186573	-0.65847	-0.30313
60-69%	5.29708	5.03842	0.258662	5.20437	5.22449	-.020126	-0.09271	-0.27879
70-79%	6.3519	5.64324	0.708656	6.26668	6.01214	0.254537	-0.08522	-0.45412
80-89%	6.48277	5.81398	0.66879	6.1285	5.99834	0.13016	-0.35427	-0.53863
COMPARISON HOSPITALS OCCUPANCY RATE:								
0-59%	5.61424	5.8631	-.248852	5.25676	6.23717	-0.98041	-0.35749	-0.73156
60-69%	5.97967	5.8211	0.158571	5.75545	6.0385	-.283055	-0.22422	-0.44163
70-79%	6.62706	6.37632	0.250738	6.09313	6.25799	-.164864	-0.53393	-0.41560
80-89%	7.70649	6.34368	1.36282	6.88073	6.50356	0.377177	-0.82576	-0.98564
90%+	6.87693	6.76046	0.116479	6.26441	6.75702	-.492607	-0.61252	-0.60909

Table 6.10 A

Medicaid ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7(X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i z_i+\epsilon$

INDEPENDENT VARIABLE X = Short Term Beds (in hospital)

z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 8568

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 51	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 77	$\tilde{CR}$ - CR
X: Short Term Beds (in hospital) Large: 200+ n = 62	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.61800$ P>F = 0.0001 n = 25	$\hat{\beta}_3+\hat{\beta}_5 = -0.48977$ P>F = 0.0001 n = 37	$\hat{\beta}_6+\hat{\beta}_7 = -0.12823$ P>F = 0.1946
$\tilde{X}$: Short Term Beds (in hospital) Small: 6-199 n = 66	$\hat{\beta}_3+\hat{\beta}_6 = -0.69623$ P>F = 0.0001 n = 26	$\hat{\beta}_3 = -0.22408$ P>F = 0.0386 n = 40	$\hat{\beta}_6 = -0.47215$ P>F = 0.0091
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = 0.07823$ P>F = 0.6367	$\hat{\beta}_5 = -0.26569$ P>F = 0.0301	$\hat{\beta}_7 = 0.34392$ P>F = 0.0951

Results of the analysis of the teaching status variable (Table 6.10B) indicate that PSRO concurrent review and comparison hospitals in both teaching status categories achieved statistically significant reductions in ALOS. However, for teaching hospitals the observed reduction in ALOS for comparison hospitals was significantly greater than the observed reduction for PSRO concurrent review hospitals ($\hat{\beta}_6+\hat{\beta}_7$). Furthermore, the statistically significant $\hat{\beta}_7$ term implies that the diffentially greater impact in reducing ALOS achieved by the comparison hospitals was significantly greater in teaching than in non-teaching hospitals.

Turning next to the short-term beds per 1000 county population variable (Table 6.10C) we observe that PSRO concurrent review and comparison hospital groups both achieved statistically significant reductions in ALOS for both high (≥4.75 beds/1000) and low bed density areas. The significant $\hat{\beta}_5$ term indicates that PSRO concurrent review hospitals reduced ALOS significantly more in high bed density areas than in low bed density areas. Further, the $\hat{\beta}_6$ term implies that in low bed density areas comparison hospitals were significantly more effective in reducing ALOS than were PSRO concurrent review hospitals. The significant $\hat{\beta}_7$ term implies that although the comparison hospitals achieved greater reductions in ALOS for both high and low density groups, the differential impact was significantly greater in areas with low bed population ratios.

The results of the analysis of the M.D.'s per 1000 county population variable are shown in Table 6.10D. The significant $\hat{\beta}_5$ term in this regression model implies that the reduction in ALOS achieved by PSRO concurrent review hospitals in low (<1.5 M.D.'s/1000) physician density areas was significantly greater than the reduction in ALOS achieved by PSRO concurrent review hospitals in high M.D. density areas. In addition, we see from the significant $\hat{\beta}_6+\hat{\beta}_7$ term that, in high physician density areas, significantly greater reductions in ALOS were observed for comparison hospitals than for PSRO concurrent review hospitals.

Table 6.10 B

Medicaid ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i z_i+\varepsilon$

INDEPENDENT VARIABLE X = Teaching Status

z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 8568

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 51	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 77	$\tilde{CR}$ - CR
X: Teaching Status Teaching n = 35	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7$ = -0.84181 P>F = 0.0001 n = 10	$\hat{\beta}_3+\hat{\beta}_5$ = -0.40532 P>F = 0.0001 n = 25	$\hat{\beta}_6+\hat{\beta}_7$ = -0.43648 P>F = 0.0009
$\tilde{X}$: Teaching Status Non-teaching n = 93	$\hat{\beta}_3+\hat{\beta}_6$ = -0.49730 P>F = 0.0001 n = 41	$\hat{\beta}_3$ = -0.44800 P>F = 0.0001 n = 52	$\hat{\beta}_6$ = -0.04930 P>F = 0.6766
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7$ = -0.34451 P>F = 0.0157	$\hat{\beta}_5$ = 0.04268 P>F = 0.6809	$\hat{\beta}_7$ = -0.38718 P>F = 0.0281

Table 6.10 C

Medicaid ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i z_i+\varepsilon$

INDEPENDENT VARIABLE X = Short Term NonFederal Beds/1000 Pop. (in county)

z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 8568

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 51	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 77	$\tilde{CR}$ - CR
X: Short Term NonFederal Beds/1000 Pop. (in county) High: 4.750+ n = 72	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.60215$ P>F = 0.0001 n = 28	$\hat{\beta}_3+\hat{\beta}_5 = -0.51746$ P>F = 0.0001 n = 44	$\hat{\beta}_6+\hat{\beta}_7 = -0.08469$ P>F = 0.4569
$\tilde{X}$: Short Term NonFederal Beds/1000 Pop. (in county) Low: 0-4.749 n = 56	$\hat{\beta}_3+\hat{\beta}_6 = -0.73307$ P>F = 0.0001 n = 23	$\hat{\beta}_3 = -0.21994$ P>F = 0.0227 n = 33	$\hat{\beta}_6 = -0.51313$ P>F = 0.0002
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = 0.13091$ P>F = 0.3464	$\hat{\beta}_5 = -0.2975$ P>F = 0.008	$\hat{\beta}_7 = 0.42844$ P>F = 0.0168

Table 6.10 D

Medicaid ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Active NonFederal Physicians/1000 Pop. (in county)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 8568

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 51	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 77	$\tilde{CR}$ - CR
X: Active NonFederal Physicians/1000 Pop. (in county) High: 1.5+ n = 51	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7$ = -0.59526 P>F = 0.0001 n = 15	$\hat{\beta}_3+\hat{\beta}_5$ = -0.29382 P>F = 0.0001 n = 36	$\hat{\beta}_6+\hat{\beta}_7$ = -0.30144 P>F = 0.0356
$\tilde{X}$: Active NonFederal Physicians/1000 Pop. (in county) Low: 0-1.49 n = 77	$\hat{\beta}_3+\hat{\beta}_6$ = -0.67401 P>F = 0.0001 n = 36	$\hat{\beta}_3$ = -0.56667 P>F = 0.0001 n = 41	$\hat{\beta}_6$ = -0.10734 P>F = 0.3398
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7$ = 0.07875 P>F = 0.5999	$\hat{\beta}_5$ = 0.27285 P>F = 0.0082	$\hat{\beta}_7$ = -0.19410 P>F = 0.2858

Results of the analysis of the extended care facility beds per 1000 county population over age 65 variable are displayed in Table 6.10E. Examination of the $\hat{\beta}_6+\hat{\beta}_7$ and $\hat{\beta}_6$ terms shows that comparison hospitals achieved greater reductions in ALOS than PSRO concurrent review hospitals both in areas with high (≥1.5 ECF beds/1000 over age 65) and low densities of ECF beds. However, only the $\hat{\beta}_6+\hat{\beta}_7$ term was statistically significant, implying a significant difference between comparison and PSRO concurrent review hospitals in the high ECF bed density areas.

Review of the results of the hospital occupancy rate variable (Table 6.10F) indicates that PSRO concurrent review and comparison hospitals both achieved statistically significant reductions in ALOS for both high (≥70%) and low occupancy rate hospitals. In addition, the $\hat{\beta}_6+\hat{\beta}_7$ term was marginally statistically significant, implying that in high occupancy rate hospitals, significantly greater reductions in ALOS were observed for comparison hospitals than for PSRO concurrent review hospitals.

6.2.5 Relationship of ALOS and Delegation Status

The same procedures were used to study the relationship between adjusted ALOS and Delegation Status as were described in Section 5.2.5 for the Medicare sample. Again the basic GLS regression model was applied for the ALOS adjusted for ELOS and ALOS-ELOS dependent variables. The estimation results are presented in Table 6.10G. As expected, the two different specifications yield virtually identical results. Moreover, the signs, magnitudes, and levels of statistical significance are in excellent agreement with the Medicare Results presented in Table 5.10G. As before we find that the initial adjusted ALOS's were significantly greater (P = .0001) in the non-delegated compared with the delegated hospitals, although the differential ($\hat{\beta}_1$ = -0.38) is considerably less than was observed for the Medicare sample where the corresponding value was -0.52. Similarly we find that the adjusted ALOS decreased significantly between the pre and post periods for non-delegated hospitals ($\hat{\beta}_2$ = -0.51, P = .0001); again, however the decrease

Table 6.10 E

Medicaid ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Extended Care Beds/1000 Pop 65+ (in county)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 8568

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 51	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 77	$\tilde{CR}$ - CR
X: Extended Care Beds/1000 Pop. 65+ (in county) High: 1.5 n = 36	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.60449$ P>F = 0.0001 n = 12	$\hat{\beta}_3+\hat{\beta}_5 = -0.25398$ P>F = 0.0090 n = 24	$\hat{\beta}_6+\hat{\beta}_7 = -0.35051$ P>F = 0.0139
$\tilde{X}$: Extended Care Beds/1000 Pop. 65+ (in county) Low: 0-1.49 n = 92	$\hat{\beta}_3+\hat{\beta}_6 = -0.64660$ P>F = 0.0001 n = 39	$\hat{\beta}_3 = -0.49584$ P>F = 0.0001 n = 53	$\hat{\beta}_6 = -0.15076$ P>F = 0.1795
$X - \tilde{X}$	$\hat{\beta}_5+\hat{\beta}_7 = 0.04211$ P>F = 0.7642	$\hat{\beta}_5 = 0.24186$ P>F = 0.0350	$\hat{\beta}_7 = -0.19975$ P>F = 0.2704

Table 6.10F

Medicaid ALOS Regression Results for Selected Independent Variables

FORM: $ALOS = \beta_0+\beta_1 X+\beta_2 STYPE+\beta_3 TIME+\beta_4 X\cdot STYPE+\beta_5 X\cdot TIME+\beta_6 STYPE\cdot TIME+\beta_7 (X\cdot STYPE\cdot TIME)+\beta_8 ELOS+\sum_{i=9}^{13}\beta_i Z_i+\varepsilon$

INDEPENDENT VARIABLE X = Occupancy Rate (in hospital)

Z_i = other 5 independent binary variables

NUMBER OF OBSERVATIONS = 8568

n = number of hospitals in each category

BINARY FORM OF INDEPENDENT VARIABLE	COMPARISON HOSPITALS: $\tilde{CR}$ n = 51	PSRO CONCURRENT REVIEW HOSPITALS: CR n = 77	$\tilde{CR}$ - CR
X: Occupancy Rate (in hospital) High: 70%+ n = 75	$\hat{\beta}_3+\hat{\beta}_5+\hat{\beta}_6+\hat{\beta}_7 = -0.67066$ P>F = 0.0001 n = 31	$\hat{\beta}_3+\hat{\beta}_5 = -0.47043$ P>F = 0.0001 n = 44	$\hat{\beta}_6+\hat{\beta}_7 = -0.20023$ P>F = 0.0422
$\hat{X}$: Occupancy Rate (in hospital) Low: 0% - 69.9% n = 53	$\hat{\beta}_3+\hat{\beta}_6 = -0.49060$ P>F = 0.0022 n = 20	$\hat{\beta}_3 = -0.30190$ P>F = 0.0024 n = 33	$\hat{\beta}_6 = -0.18870$ P>F = 0.3157
$X - \hat{X}$	$\hat{\beta}_5+\hat{\beta}_7 = -0.18006$ P>F = 0.3113	$\hat{\beta}_5 = -0.16853$ P>F = 0.1455	$\hat{\beta}_7 = -0.1153$ P>F = 0.9567

Table 6.10C

Analysis Results of the Relationship Between Average Length of Stay, Expected Length, Delegation Status and Time: MEDICAID

Dependent Variable: ALOS

FORM: $ALOS = \beta_0 + \beta_1 DSTAT + \beta_2 TIME + \beta_3 (DSTAT \cdot TIME) + \beta_4 ELOS + \varepsilon$

NUMBER OF OBSERVATIONS = 5264
DEGREES OF FREEDOM = 5269

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STANDARD ERROR OF ESTIMATE
β_0 CONSTANT	.79811426	9.17	.0001	.08699940
β_1 DSTAT	-.38387940	-5.12	.0001	.07493458
β_2 TIME	-.50607940	-6.69	.0001	.0756095
β_3 D X T	.11147253	1.10	.2735	.10179537
β_4 ELOS	.99581692	81.58	.0001	.01220722

Dependent Variable: ALOS-ELOS

FORM: $ALOS = \beta_0 + \beta_1 DSTAT + \beta_2 TIME + \beta_3 (DSTAT \cdot TIME) + \varepsilon$

NUMBER OF OBSERVATIONS = 5265
DEGREES OF FREEDOM = 5269

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STANDARD ERROR OF ESTIMATE
β_0 CONSTANT	.77491576	14.18	.0001	.05464776
β_1 DSTAT	-.38363070	-5.12	.0001	.07492742
β_2 TIME	-.50710068	-6.71	.0001	.07554415
β_3 D X T	.11153588	1.10	.2732	.10179021

Table 6.10H

Medicaid ALOS Regression Results for Delegated, Nondelegated, and All PSRO Concurrent Review Hospitals vs. Comparison Hospitals

FORM: $ALOS = \beta_0+\beta_1 \cdot STYPE+\beta_2 \cdot TIME+\beta_3(STYPE \cdot TIME)+\sum_{i=4}^{9}\beta_i Z_i+\beta_{10} ELOS+\epsilon$

Z_i = 6 independent binary variables (Teaching Status, Bedsize, etc.)

n = number of hospitals in each category

HOSPITAL GROUPS COMPARED	COMPARISON HOSPITALS: $\tilde{CR}$	PSRO CONCURRENT REVIEW HOSPITALS: CR	$\tilde{CR}$ - CR
Delegated PSRO CR vs. Comparison Hospitals n = 100 Number of Observ.= 6541	$\hat{\beta}_2+\hat{\beta}_3 = -0.63371$ P>F = 0.0001 n = 51	$\hat{\beta}_2 = -0.34595$ P>F = 0.0001 n = 49	$\hat{\beta}_3 = -0.28776$ P>F = 0.0030
Nondelegated PSRO CR vs. Comparions Hospitals n = 79 Number of Observ.= 5142	$\hat{\beta}_2+\hat{\beta}_3 = -0.66433$ P>F = 0.0001 n = 51	$\hat{\beta}_2 = -0.50297$ P>F = 0.0001 n = 28	$\hat{\beta}_3 = -0.16136$ P>F = 0.1415

Table 6.101

Medicaid ALOS Regression Results by Geographic Census Region

FORM: $ALOS = \beta_0+\beta_1 \cdot STYPE+\beta_2 \cdot TIME+\beta_3(STYPE \cdot TIME)+\sum_{i=4}^{9} \beta_i Z_i+\beta_{10} ELOS+\varepsilon$

Z_i = 6 independent binary variables (Teaching Status, Bedsize, etc.)

n = number of hospitals in each category

Geographic Census Region	COMPARISON HOSPITALS: $\tilde{CR}$	PSRO CONCURRENT REVIEW HOSPITALS: CR	$\tilde{CR}$ - CR
Region 1: Northeast n = 9 Number of Observ.= 793	$\hat{\beta}_2+\hat{\beta}_3$ = -0.72480 P>F = 0.0001 n = 8	$\hat{\beta}_2$ = Insuffic. Data P>F = Insuffic. Data n = 1	$\hat{\beta}_3$ = Insuffic. Data P>F = Insuffic. Data
Region 2: North Central n = 52 Number of Observ.= 3615	$\hat{\beta}_2+\hat{\beta}_3$ = -0.31484 P>F = 0.0136 n = 16	$\hat{\beta}_2$ = -0.52786 P>F = 0.0001 n = 36	$\hat{\beta}_3$ = 0.21302 P>F = 0.1413
Region 3: South n = 32 Number of Observ.= 1998	$\hat{\beta}_2+\hat{\beta}_3$ = -0.89409 P>F = 0.0001 n = 18	$\hat{\beta}_2$ = -0.49554 P>F = 0.0001 n = 14	$\hat{\beta}_3$ = -0.39855 P>F = 0.0383
Region 4: West n = 35 Number of Observ.= 2162	$\hat{\beta}_2+\hat{\beta}_3$ = -0.90678 P>F = 0.0001 n = 9	$\hat{\beta}_2$ = -0.13092 P>F = 0.1491 n = 26	$\hat{\beta}_3$ = -0.77586 P>F = 0.0001
All U.S.A. (Total Regions 1-4) n = 128 Number of Observ.= 8568	$\hat{\beta}_2+\hat{\beta}_3$ = -0.63419 P>F = 0.0001 n = 51	$\hat{\beta}_2$ = -0.42564 P>F = 0.0001 n = 77	$\hat{\beta}_3$ = -0.20855 P>F = 0.0165

in the west reduced their lengths of stay for Medicaid over three-fourths of a day more than did the PSRO concurrent review hospitals in that region. As a reference level, the main results of our ALOS analysis for all 4 regions combined are shown on the bottom line of Table 6.10I.

These findings would tend to indicate that Medicaid PSRO concurrent review was less effective in reducing ALOS in the southern and western census regions than it was in the north central. As was the case for Medicare, this result is not surprising in view of the traditionally longer lengths of stay in the north central region as compared with the south and west. Furthermore, displaying the Medicaid hospitals by region and PSRO concurrent review start quarter (Table 6.10J), we see that PSRO concurrent review hospitals tended generally to start review earlier in the south and west than in the north central census region. Hence, the poor performance of the PSRO concurrent review hospitals in the south and west during our study period may be due in part to their having started review earlier; their lengths of stay may have already been pushed downward during the "pre-review" period as a result of warmup or other unknown utilization review programs that predated Title 19 binding PSRO review. To complete the regression analysis, a correlation coefficient matrix was generated weighting each pre/post hospital-diagnosis-quarter observation by the number of patients therein. Continuous variables included in the correlation were ALOS, ELOS, hospital occupancy rate, number of short-term beds in the hospital, M.D.'s per 1000 county population, extended care beds per 1000 county population aged 65 and over, short-term beds per 1000 county population, and geographic census region (1,...,4). Binary variables included were teaching status, study type, time (pre-post), and the cross-product term STYPE·TIME. The matrix is presented in Table 6.10K. The output from the computer runs which generated each of the regression estimates discussed in this chapter can be obtained (at the cost of reproduction) from the Commission on Professional and Hospital Activities, 1968 Green Road, Ann Arbor, Michigan 48105, Attention: Project Development Department.

Table 6.10J

NUMBER OF MEDICAID HOSPITALS BY GEOGRAPHIC CENSUS REGION
STUDY TYPE & QUARTER OF PSRO CR START

TABLE OF REGIONAM BY QTRSTART

REGIONAM REGION NAME QTRSTART QUARTER PSRO CR BEGAN

FREQUENCY / PERCENT / ROW PCT / COL PCT	A:4TH QTR 1974	B:2ND QTR 1975	C:3RD QTR 1975	D:4TH QTR 1975	X:NEVER STARTED	TOTAL
NORTH EAST	1	0	0	0	8	9
	0.78	0.00	0.00	0.00	6.25	7.03
	11.11	0.00	0.00	0.00	88.89	
	25.00	0.00	0.00	0.00	15.69	
NORTH CENT.	0	3	1	32	16	52
	0.00	2.34	0.78	25.00	12.50	40.63
	0.00	5.77	1.92	61.54	30.77	
	0.00	50.00	5.88	64.00	31.37	
SOUTH	0	0	3	11	18	32
	0.00	0.00	2.34	8.59	14.06	25.00
	0.00	0.00	9.38	34.38	56.25	
	0.00	0.00	17.65	22.00	35.29	
WEST	3	3	13	7	9	35
	2.34	2.34	10.16	5.47	7.03	27.34
	8.57	8.57	37.14	20.00	25.71	
	75.00	50.00	76.47	14.00	17.65	
TOTAL	4	6	17	50	51	128
	3.13	4.69	13.28	39.06	39.84	100.00

Table 6.10K

MEDICAID MATRIX --- WEIGHTED BY THE NUMBER OF PATIENTS IN EACH HOSPITAL-DIAGNOSIS-QUARTER(3 PRE & 3 POST) OBSERVATION

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 8568

	ALOS	ELOS	TEACHING	OCCPRATE	SHORTBED	MDSCKPOP	ECBEDSCK	BEDSCKPO	REGION	STYPE	TIME	S_T
ALOS	1.00000 0.0000	0.73207 0.0001	0.10269 0.0001	0.19010 0.0001	0.17898 0.0001	0.08322 0.0001	-0.01348 0.2121	0.08849 0.0001	-0.11631 0.0001	0.11081 0.0001	-0.05488 0.0001	0.03382 0.0017
ELOS	0.73207 0.0001	1.00000 0.0000	0.02317 0.0320	0.15037 0.0001	0.05704 0.0001	-0.01039 0.3360	-0.01010 0.3501	0.04146 0.0001	-0.20027 0.0001	0.15299 0.0001	0.04731 0.0001	0.11392 0.0001
TEACHING	0.10269 0.0001	0.02317 0.0320	1.00000 0.0000	0.29601 0.0001	0.53816 0.0001	0.47579 0.0001	-0.06754 0.0001	0.29576 0.0001	-0.04162 0.0001	-0.13314 0.0001	-0.03870 0.0003	-0.10571 0.0001
OCCPRATE	0.19010 0.0001	0.15037 0.0001	0.29601 0.0001	1.00000 0.0000	0.42974 0.0001	0.05817 0.0001	0.11090 0.0001	0.15692 0.0001	-0.25227 0.0001	0.11496 0.0001	0.01976 0.0674	0.09126 0.0001
SHORTBED	0.17898 0.0001	0.05704 0.0001	0.53816 0.0001	0.42974 0.0001	1.00000 0.0000	0.50190 0.0001	-0.08021 0.0001	0.21269 0.0001	-0.17763 0.0001	0.00738 0.4948	-0.02498 0.0208	0.00446 0.6800
MDSCKPOP	0.08322 0.0001	-0.01039 0.3360	0.47579 0.0001	0.05817 0.0001	0.50190 0.0001	1.00000 0.0000	0.10438 0.0001	0.37691 0.0001	0.08704 0.0001	-0.08852 0.0001	-0.04497 0.0001	-0.08945 0.0001
ECBEDSCK	-0.01348 0.2121	-0.01010 0.3501	-0.06754 0.0001	0.11090 0.0001	-0.08021 0.0001	0.10438 0.0001	1.00000 0.0000	-0.19348 0.0001	0.11237 0.0001	-0.00544 0.6147	-0.00857 0.4277	-0.00851 0.4307
BEDSCKPO	0.08849 0.0001	0.04146 0.0001	0.29576 0.0001	0.15692 0.0001	0.21269 0.0001	0.37691 0.0001	-0.19348 0.0001	1.00000 0.0000	-0.04710 0.0001	-0.10061 0.0001	-0.01301 0.2285	-0.08825 0.0001
REGION	-0.11631 0.0001	-0.20027 0.0001	-0.04162 0.0001	-0.25227 0.0001	-0.17763 0.0001	0.08704 0.0001	0.11237 0.0001	-0.04710 0.0001	1.00000 0.0000	-0.22081 0.0001	-0.01835 0.0894	-0.14922 0.0001
STYPE	0.11081 0.0001	0.15299 0.0001	-0.13314 0.0001	0.11496 0.0001	0.00738 0.4948	-0.08852 0.0001	-0.00544 0.6147	-0.10061 0.0001	-0.22081 0.0001	1.00000 0.0000	0.03088 0.0043	0.68260 0.0001
TIME	-0.05488 0.0001	0.04731 0.0001	-0.03870 0.0003	0.01976 0.0674	-0.02498 0.0208	-0.04497 0.0001	-0.00857 0.4277	-0.01301 0.2285	-0.01835 0.0894	0.03088 0.0043	1.00000 0.0000	0.45497 0.0001
S_T	0.03382 0.0017	0.11392 0.0001	-0.10571 0.0001	0.09126 0.0001	0.00446 0.6800	-0.08945 0.0001	-0.00851 0.4307	-0.08825 0.0001	-0.14922 0.0001	0.68260 0.0001	0.45497 0.0001	1.00000 0.0000

6.3 LENGTH OF STAY DISTRIBUTION ANALYSIS

The primary purpose of the analysis of the distribution of length of stay is to assess the effect of PSRO concurrent review activity on changing the distribution of Medicaid patients' LOS in the hospital. This analysis is intended to augment the ALOS analysis in that the mean of the length of stay distribution may not change between periods or across hospital type; but the distribution in terms of percent short stays and percent long stays may change considerably. This would have important policy implications for the PSRO concurrent review activity. The same evaluation design and regression analysis approach used in the Medicare analysis were employed.

The % Short and % Long Stay variables were developed through the use of the CPHA Length of Stay Study (LSS) program described in the methodology which was also used to generate the ELOS calculation. The definition of a Short Stay for the LSS program is any stay less than the fifth percentile for matched patients. A Long Stay is any stay greater than the seventy-fifth percentile for matched patients. The patient matching technique uses the same patient characteristics as ELOS.

Before the results of the statistical tests of the hypotheses are given, some basic characteristics of the trends in the % Short and % Long Stays for the PSRO concurrent review and comparison hospitals are described.

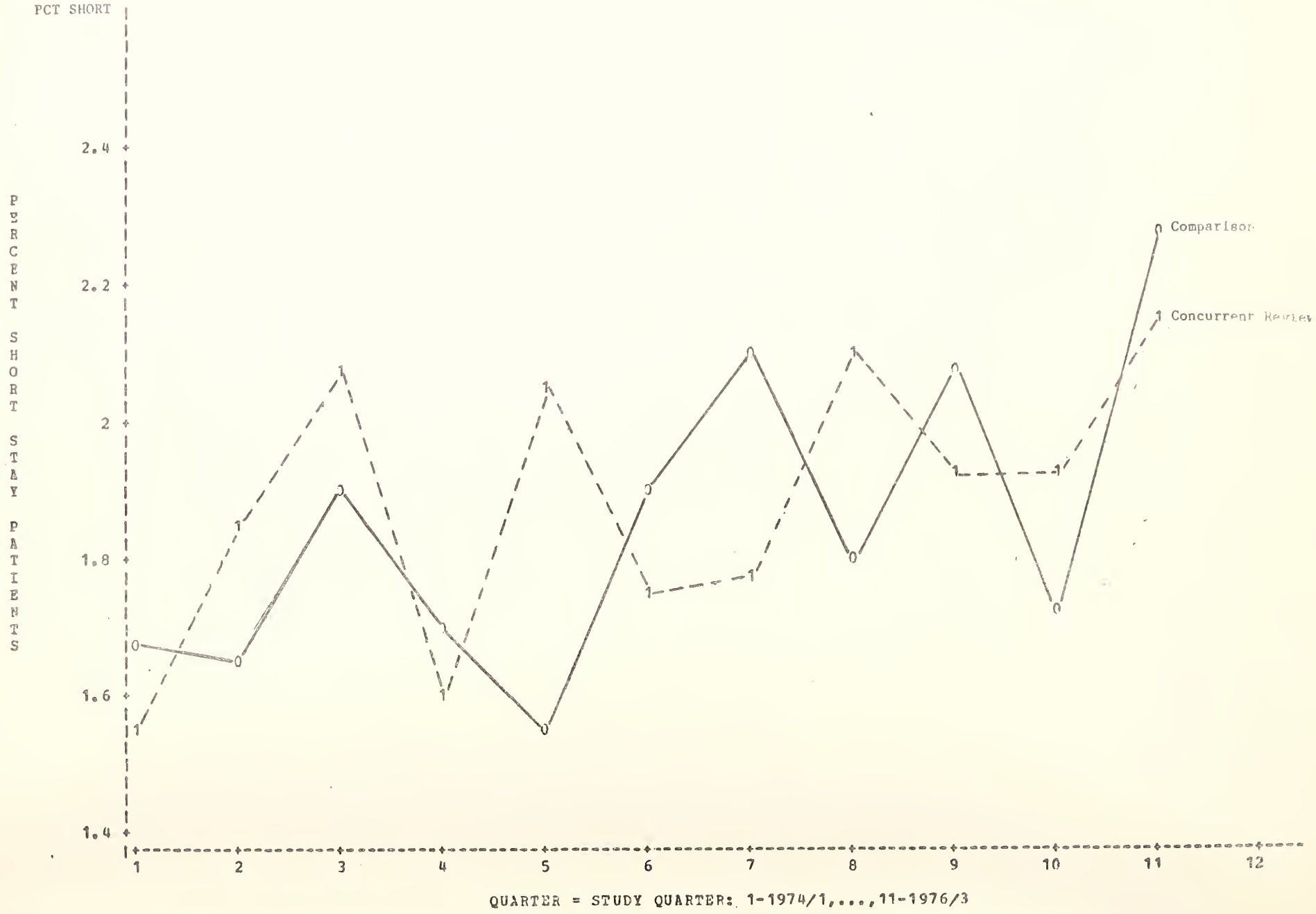
6.3.1 Trends in % Short and % Long Stays

The trends in the % Short Stays and % Long Stays for Medicaid patients over the eleven quarter time period reflect a general narrowing of the length of stay distribution. As shown in Figure 6.4, the % Short Stays are seen to be increasing over time for both the concurrent review and comparison hospitals. The % Short Stays in concurrent review hospitals increased from 1.67% of all discharges to

Figure 6.4

PERCENT OF SHORT STAY PATIENTS (UNDER 5TH %-TILE) BY QUARTER
FOR STUDY (0) AND COMPARISON (1) HOSPITALS --- MEDICAID

PLOT OF QUARTER*PCTSHORT LEGEND: SYMBOL IS VALUE OF STYPE



2.26% by the end of the time period. The comparison hospital group increased its % Short Stays by an almost identical amount from 1.54% in the first quarter of 1974 to 2.14% by the third quarter of 1976.

The % Long Stays exhibited a steadily decreasing trend over the time period with a considerably more pronounced change than that observed for the % Short Stays. In the concurrent review hospitals the % Long Stays declined from 26.16% to 19.26% over the time period. An almost identical percent change was found for the comparison group which began the period with 26.28% long stays and had decreased to 20.62% by the third quarter of 1976. Figure 6.5 shows the trends in % Long Stays for the concurrent review and comparison hospitals. Unlike the Medicare sample population, the Medicaid % Long Stay for the concurrent review and comparison hospitals were approximately equal throughout the time period. In the Medicare analysis, the % Long Stays in the concurrent review hospital were higher than the comparison hospitals for most of the quarters included in the analysis.

The analysis of the Medicaid % Long Stays and % Short Stay trends is given in Table 6.11. From the t-values and their associated probabilities, it may be seen that there is no statistically significant difference between the slopes of the best fit lines for concurrent review and comparison hospitals for either % Short or % Long Stays. The values by quarter for % Short Stays and % Long Stays for concurrent review and comparison hospitals are given in Table 6.12.

Figure 6.5

PERCENT OF LONG STAY PATIENTS (OVER 75TH %-TILE) BY QUARTER
FOR STUDY (0) AND COMPARISON (1) HOSPITALS --- MEDICAID

PLOT OF QUARTER*PCTLONG LEGEND: SYMBOL IS VALUE OF STYPE

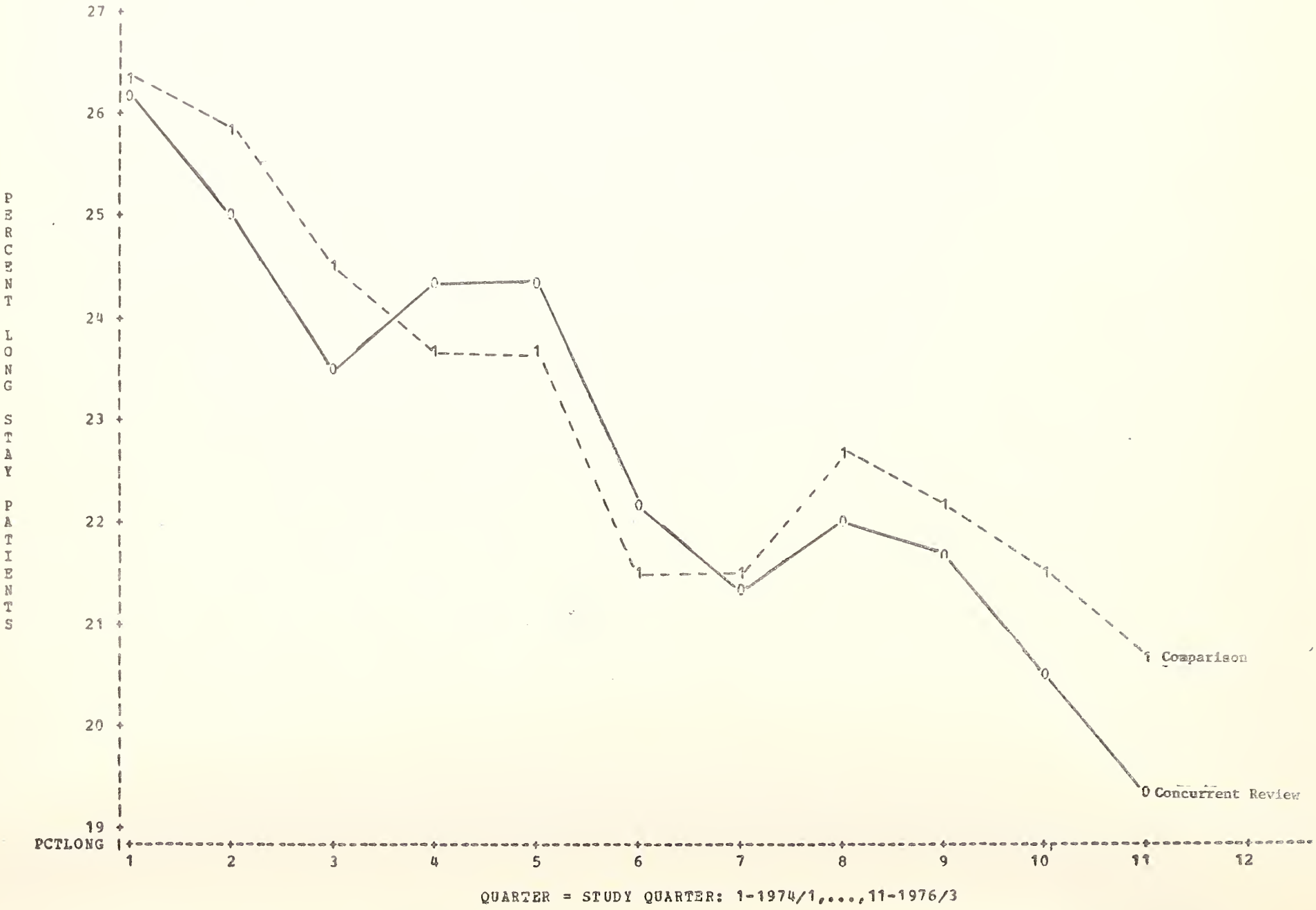


TABLE 6.11

Test of Differences in Slopes of % of Short Stays and % of Long Stays
Between Concurrent Review and Comparison Hospitals: Medicaid

Dependent Variable	Number of Observations	Slope CR Hospitals	Slope Comparison Hospitals	Differences in Slope Comparison-CR	t-Value	P-Value
% Short Stays	11	.041	.032	-.009	-0.38	.7113
% Long Stays	11	-.592	-.513	.079	0.79	.4403

TABLE 6.12

% Short Stays and % Long Stays by Quarter for
Concurrent Review and Comparison Hospitals: Medicaid

Quarter / Hosp. Group	1974				1975				1976		
	1	2	3	4	1	2	3	4	1	2	3
% Short Stays:											
Concurrent Review	1.67	1.66	1.89	1.69	1.54	1.90	2.10	1.80	2.07	1.72	2.26
Comparison	1.54	1.86	2.07	1.60	2.05	1.75	1.76	2.09	1.91	1.94	2.14
% Long Stays:											
Concurrent Review	26.16	24.93	23.53	24.36	24.28	22.24	21.32	22.04	21.67	20.57	19.26
Comparison	26.28	25.80	24.43	23.66	23.63	21.50	21.55	22.68	22.17	21.43	20.62

6.3.2 Pre-Post Analysis of % Short and % Long Stays

When the changes in the % Short Stays and % Long Stays between the pre-review and post-review period for concurrent review and comparison hospitals were examined, it was found that the % Short Stays increased somewhat more in the concurrent review than in comparison hospitals.

The difference between the two groups, however, was quite small (.12%) and was not found to be statistically significant in the subsequent regression analysis.

The relative decrease in the % Long Stays between hospital groups was also quite small with the concurrent review hospitals showing a decline of 4.27%, between the pre-review and post-review periods versus a 3.99% decline for the comparison hospitals. The difference between the two groups was only .28% and was not statistically significant at $p < .05$. Table 6.13 presents the changes between pre and post periods for % Short Stays and % Long Stays by hospital group.

TABLE 6.13

CHANGE IN % SHORT STAYS (LOS < 5th PERCENTILE) AND % LONG STAYS (LOS > 75th PERCENTILE) FOR CONCURRENT REVIEW AND COMPARISON HOSPITALS: MEDICAID

Period / Hospital Group	Pre-Review	Post-Review	Differences	
			(Post-Pre)	(Post-Pre) Comparison -(Post-Pre) CR
% Short Stays				
Concurrent Review	1.74	2.01	.27	-.12
Comparison	1.84	1.99	.15	
% Long Stays				
Concurrent Review	24.83	20.56	-4.27	+.28
Comparison	25.43	21.44	-3.99	

Table 6.14 presents the number and percent of hospitals by direction of change in the % Short Stays and % Long Stays for the concurrent review and comparison hospitals. For % Short Stays, it may be seen that while 57.1% of the concurrent review hospitals experienced an increase in the % Short Stays, 66.7% of the comparison hospitals also experienced an increase. However, the interaction of the direction of pre-post change and hospital group is not statistically significant ($X^2 = 1.227$, $P = 0.2679$).

Very little difference in the percent distribution of hospitals by hospital group and direction of change for % Long Stays is observed. Seventy-four percent of the concurrent review hospitals experienced a decrease in the % Long Stays while 70.6% of the comparison hospitals also had a drop in the % Long Stays. As with the % Short Stays, the slight difference in the proportion is not statistically significant ($X^2 = 0.183$, $P = 0.6692$).

The statistical significance of the changes in Medicaid % Short Stays and % Long Stays as a function of hospital type, time, and the interaction effects of these two variables was tested using a linear regression model. The form of the model is identical to that used in the Medicare utilization analysis. The results of the regression analysis are given in Table 6.15.

Table 6.14

Number and Percent of Hospitals by Direction of Change in % Short Stays and % Long Stays for Concurrent Review and Comparison Hospitals: MEDICAID

Hospital Group \ Direction of Change		(% Short Stays)Post -(%Short Stays)Pre			Total
		<0	=0	>0	
Concurrent Review	N	30	3	44	77
	%	39.0	3.9	57.1	100.0%
Comparison	N	15	2	34	51
	%	29.4	3.9	66.7	100.0%
TOTAL	N	45	5	78	128
	%	35.2	3.9	60.9	100.0%

(Chi-Square = 1.227, P = 0.2679, DF = 1 (for 2 x 2 table with 0 and 0 categories combined.)

Hospital Group \ Direction of Change		(% Long Stays)Post -(%Long Stays)Pre			Total
		<0	=0	>0	
Concurrent Review	N	57	1	19	77
	%	74.0	1.3	24.7	100.0%
Comparison	N	36	1	14	51
	%	70.6	2.0	27.4	100.0%
TOTAL	N	93	2	33	128
	%	727	1.6	25.7	100.0%

(Chi-Square = 0.183, P = 0.6692, DF = 1 (for 2 x 2 table with 0 and 0 categories combined.)

Table 6.15

Analysis Results of the Relationship Between % Short Stays, % Long Stays, Hospital Review Types, and Time: MEDICAID

Dependent Variable: % Short Stays FORM: % Short Stays = $\beta_0 + \beta_1$ STYPE + β_2 TIME + β_3 (STYPE•TIME) + ϵ

NUMBER OF OBSERVATIONS = 8568
DEGREES OF FREEDOM = 8564

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STANDARD ERROR OF ESTIMATE
β_0 CONSTANT	1.74310117	18.65	0.0001	0.09346673
β_1 STYPE	0.09795197	9.60	0.5463	0.16234134
β_2 TIME	0.27219521	2.13	0.0334	0.12790530
β_3 S X T	-0.11598873	-0.54	0.5870	0.21351740

Dependent Variable : % Long Stays FORM: % Long Stays = $\beta_0 + \beta_1$ STYPE + β_2 TIME + β_3 (STYPE•TIME) + ϵ

NUMBER OF OBSERVATIONS = 8568
DEGREES OF FREEDOM = 8564

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STANDARD ERROR OF ESTIMATE
β_0 CONSTANT	24.84576396	90.72	0.0001	0.27386275
β_1 STYPE	9.56731805	1.19	0.2330	0.47566921
β_2 TIME	-4.32638331	-11.54	0.0001	0.37476969
β_3 S X T	0.30372446	0.49	0.6273	0.62561791

It can be seen from the coefficients for % Short Stays regression that the % Short Stays in the pre-review period for concurrent review and comparison hospitals were not significantly different from one another (β_1 = 0.09792 with a standard error of 0.16234). Confirming in previous findings given in Table 6.13, the β_2 coefficient of the TIME term indicates that the % Short Stays increased by .27% on the average between the pre-review and post review periods for concurrent review hospitals which is statistically significant with p = .0334. The increase in the % Short Stays for the comparison hospitals was .15% ($\beta_2 + \beta_3$ = .27 - .12 = .15). This difference between the increase in % Short Stays for the two hospital groups is not statistically significant, however.

Therefore, with regard to the % Short Stays for Medicaid patients, there is not sufficient evidence to reject the null hypothesis that changes in the % Short Stays between pre-review and post-review periods are equal for concurrent review and comparison hospitals.

The analysis of the % Long Stays for Medicaid patients is equally interesting. Although the concurrent review hospitals, on the average, experienced a decline of 4.33% with % Long Stays (β_2 = -4.33) which was significant at p = 0.0001, the interaction term (β_3 = .30, t = 0.49, p = 0.6273) shows the difference between the concurrent review and comparison groups to be statistically insignificant. Therefore, it may be concluded that there is not sufficient evidence to reject the null hypothesis that changes in the % Long Stays between pre-review and post review periods are equal for concurrent review and comparison hospitals. The PSRO had no identifiable impact on the reduction of the % Long Stays for Medicaid patients beyond what would have been expected in the absence of the review activity.

6.3.3 Diagnostic Specific Pre-Review, Post-Review Analysis of % Short and % Long Stays

The twenty-two diagnosis groups were analyzed to determine whether or not significant changes could be identified in % Short Stays or % Long Stays between pre-review and post-review periods for any specific diagnosis groups.

The results of the analysis are presented in Tables 6.16 and 6.17 for the % Short Stay variable. From the first table, it may be seen that twelve diagnosis groups increased the % Short Stays between the two time periods for the concurrent review hospitals. However, in only seven groups was the increase in % Short Stays greater than one percent. The largest changes in % Short Stays for the concurrent review hospitals were for the diagnosis groups Fracture of Femur (DX # 18) with an increase of 6.35%, Malignant Neoplasm of Breast (DX # 15) with 5.40% increase, and Cerebrovascular Disease (DX # 11) with an increase of 2.47% between the pre- and post-review time periods. Two diagnosis groups had relatively large decreases in the % Short Stays in the concurrent review hospitals: Hyperplasia Prostate (DX # 8) with a decrease of 3.64% and Urinary Tract Infection (DX # 4) with a 2.99% decrease.

When the differences between the concurrent review and comparison hospitals are examined, ten of the twenty-two diagnosis groups had increases in short stays for the concurrent review hospitals that exceeded the change observed in the comparison hospitals. Again, Fracture of Femur (DX#18) had the greatest net difference with 9.96%. In this diagnosis the % Short Stay increased in the concurrent review hospitals and decreased in the comparison hospitals. A similar pattern held for Malignant Neoplasm of the Breast (DX #15), which had a net difference of 8.63% between the two hospital groups. Cerebrovascular Disease (DX #11) and Appendicitis (DX #21) also experienced net increases in the % Short Stay between hospital groups with net increases of 3.49% and 3.18% respectively.

Table 6.16

Change in % Short Stays by Diagnostic Group for Concurrent Review and Comparison Hospitals: MEDICAID

Diagnosis Group and Hospital Group	Pre-Review	Post-Review	Differences (Post-Pre)	(Post-Pre) Com -(Post-Pre) CR
DX 1				
CR	.73	2.12	1.39	
COMP	1.16	1.42	.27	-1.12
DX 2				
CR	1.49	1.59	.10	
COMP	.86	1.73	.87	.77
DX 3				
CR	3.03	3.96	.93	
COMP	4.35	7.89	3.55	2.58
DX 4				
CR	6.50	3.51	-2.99	
COMP	2.42	2.20	- .21	2.78
DX 5				
CR	1.03	.43	- .60	
COMP	4.00	2.01	-1.99	-1.39
DX 6				
CR	1.66	1.57	- .09	
COMP	2.78	1.59	-1.10	-1.10
DX 7				
CR	1.37	2.88	1.51	
COMP	1.09	1.32	.23	-1.28
DX 8				
CR	3.64	-0-	-3.64	
COMP	2.94	-0-	-2.94	.70
DX 9				
CR	3.55	3.54	- .01	
COMP	3.92	4.06	.14	.15
DX 10				
CR	3.00	2.68	- .32	
COMP	3.37	3.63	.26	.58
DX 11				
CR	1.03	3.50	2.47	
COMP	1.02	-0-	-1.02	-3.49

Change in % Short Stays by Diagnostic Group for Concurrent Review and Comparison Hospitals: MEDICAID

Diagnosis Group and Hospital Group	Pre-Review	Post-Review	Differences (Post-Pre)	(Post-Pre) Com -(Post-Pre) CR
DX 12				
CR	1.45	2.86	1.41	
COMP	1.90	2.03	.13	-1.28
DX 13				
CR	4.17	4.50	.33	
COMP	7.14	9.00	1.86	1.53
DX 14				
CR	3.05	1.99	-1.06	
COMP	2.92	4.48	1.56	2.62
DX 15				
CR	1.18	6.58	5.40	
COMP	3.23	-0-	-3.23	-8.63
DX 16				
CR	1.72	1.54	- .18	
COMP	1.71	2.17	.46	.64
DX 17				
CR	.15	.05	-.10	
COMP	-0-	-0-	-0-	.10
DX 18				
CR	-0-	6.35	6.35	
COMP	7.69	4.08	-3.61	-9.96
DX 19				
CR	-0-	-0-	-0-	
COMP	-0-	-0-	-0-	-0-
DX 20				
CR	4.17	4.67	.50	
COMP	2.24	3.31	1.07	.57
DX 21				
CR	-0-	1.81	1.81	
COMP	5.94	3.57	-2.37	-3.18
DX 22				
CR	1.70	2.11	.41	
COMP	1.79	1.85	.06	-.35

Table 6.17

% Short Stay Regression Analysis by Diagnostic Group: MEDICAID

Dependent Variable: % Short Stays FORM: % Short Stays = $\beta_0 + \beta_1$ STYPE + β_2 TIME + β_3 (STYPE·TIME)+ϵ								
Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-value	p	estimate	t-value	p		
1. Hypertension	1.4433	1.23	.2190	-1.1853	- .65	.5142	358	354
2. Pneumonia	.1043	.18	.8546	.7713	.87	.3858	547	543
3. Heart Failure	.9624	.44	.6610	2.5961	.71	.4766	307	303
4. Urinary Trace Infection	-3.0060	-1.91	.0567	2.7265	1.00	.3175	433	429
5. Ulcer	-.6236	-.54	.5895	-1.3304	-.69	.4911	394	390
6. Cholecystitis/ Choletithiasis	-.1004	-.12	.9044	-1.0792	-.76	.4489	512	508
7. Inguinal Hernia	1.5038	1.10	.2730	-1.2428	-.59	.5588	402	398
8. Hyperplasia Prostate	-3.6577	-1.40	.1646	.6355	.16	.8758	131	127
9. Disc Development	.0207	.01	.9925	.0983	.03	.9752	316	312
10. Complications & Adverse Reactions	-.3211	-.36	.7185	.5279	.39	.6942	540	536
11. Cerebrovascular Disease	2.4506	1.44	.1525	-3.4291	-1.41	.1592	253	249
12. Chronic Ischemic Heart Disease	1.4365	1.12	.2625	-1.2616	-.68	.4967	410	406
13. Acute Myocardial Infarction	.5957	.15	.8815	1.2296	.22	.8228	224	220
14. Diabetes	-1.0734	-.84	.3988	2.6251	1.31	.1906	499	495
15. Malignant Neoplasm of Breast	5.4627	2.17	.0312	-8.5826	-2.26	.0251	171	167

Table 6.17, continued

%Short Stay Regression Analysis by Diagnostic Group: MEDICAID

Dependent Variable: % Stays FORM: % Stays = $\beta_0 + \beta_1$ STYPE + β_2 TIME + β_3 (STYPE•TIME)+ $\in$								
Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-value	p	estimate	t-value	p		
16. Delivery	-.1749	-.32	.7517	.6357	.64	.5218	575	571
17. Hypertrophy Tonsils/Adenoids	.0981	-2.77	.0058	.0967	1.39	.1651	573	569
18. Fracture of Femur	6.3000	1.77	.0785	-9.7510	-1.78	.0771	157	153
19. Cataract	N.O.			N.O.			216*	212*
20. Neuroses	.5099	.48	.6311	.5690	.34	.7338	441	437
21. Appendicitis	1.7948	1.33	.1850	-4.050	-1.73	.0839	372	368
22. Other	.4107	2.37	.0180	-.3432	-1.20	.2315	737	733

Inspection of the diagnosis specific regression results for % Short Stays presented in Table 6.17 further explains the findings in Table 6.16. Of the ten diagnosis groups that had net increases in the % Short Stays, only the change for Malignant Neoplasm of Breast remained statistically significant at $p<.05$. Based on these results, it would appear that the null hypothesis, that changes for specific diagnosis groups in the % Short Stays between pre-review and post-review periods are equal for the two hospital groups, may be rejected only for the Malignant Neoplasm of Breast diagnosis.

The results of the analysis of % Long Stays for Medicaid patients by diagnosis group are given in Tables 6.18 and 6.19. All of the diagnosis groups with the exception of Malignant Neoplasm of Breast (DX # 15) experienced reductions in the % Long Stays for the concurrent review hospitals. Ten of the diagnosis group had decreases that were statistically significant with $p<.05$. Of the ten diagnosis groups with significant declines, the greatest decreases in the % Long Stays between the pre-review and post-review period for concurrent review hospitals were shown for Hyperplasia Prostate (decrease = 19.50%), Cataract (13.86%), Disc Displacement (12.27%), Cerebrovascular Disease (12.01%), Chronic Ischemic Heart Disease (11.18%), and Cholecystitis/Choletithiasis (10.54%).

From the differences column (comparison - concurrent review) in Table 6.18, it appears that the concurrent review hospitals were more successful in reducing the % Long Stays than were the comparison hospitals. However, the p value associated with the β_3 coefficient in the regression analysis indicates that the difference between comparison and concurrent review hospitals in the changes in % Long Stays was significant at $p<.05$ for only three diagnosis groups: Cholecystitis/Choletithiasis (14.67% difference); Hyperplasia

Table 6.18

Change in % Long Stays by Diagnostic Group for Concurrent Review and Comparison Hospitals: MEDICAID

Diagnosis Group and Hospital Group	Pre-Review	Post-Review	Differences (Post-Pre)	(Post-Pre) Com -(Post-Pre) CR
DX 1	32.60	23.67	- 8.93	
CR				
COMP	33.53	28.91	- 4.62	4.31
DX 2	27.81	23.43	- 4.38	
CR	29.84	26.41	- 3.43	.95
COMP				
DX 3				
CR	25.45	19.82	- 5.63	
COMP	28.26	20.18	- 8.08	- 2.45
DX 4				
CR	26.02	25.29	- .73	
COMP	28.54	23.79	- 3.75	- 3.02
DX 5				
CR	33.10	29.06	- 4.04	
COMP	28.80	16.78	-12.02	- 7.98
DX 6				
CR	32.84	22.30	-10.54	
COMP	28.57	32.70	4.13	14.67
DX 7				
CR	26.28	22.44	- 3.84	
COMP	22.28	22.03	- .25	3.59
DX 8				
CR	43.64	24.14	-19.50	
COMP	29.41	38.64	9.23	28.73
DX 9				
CR	29.44	17.17	-12.27	
COMP	17.65	17.26	- .39	11.88
DX 10				
CR	23.00	21.07	- 1.93	
COMP	23.60	19.52	- 4.08	- 2.15
DX 11				
CR	32.99	20.98	-12.01	
COMP	20.41	25.83	5.42	17.43

Table 6.18 (continued)

Change in % Long Stays by Diagnostic Group for Concurrent Review and Comparison Hospitals: MEDICAID

Diagnosis Group and Hospital Group	Pre-Review	Post-Review	Differences (Post-Pre)	(Post-Pre) Com -(Post-Pre) CR
DX 12				
CR	27.75	16.57	-11.18	
COMP	25.86	14.53	-11.33	- .15
DX 13				
CR	27.78	20.72	- 7.06	
COMP	22.62	16.00	- 6.62	.44
DX 14				
CR	30.50	25.54	- 4.96	
COMP	33.44	21.79	-11.65	- 6.69
DX 15				
CR	25.88	34.21	8.33	
COMP	20.97	36.84	15.87	7.54
DX 16				
CR	21.19	16.14	- 5.05	
COMP	15.82	12.44	- 3.38	1.67
DX 17				
CR	6.19	5.37	- .82	
COMP	7.40	8.88	1.48	2.30
DX 18				
CR	33.33	23.81	- 9.52	
COMP	20.51	14.29	- 6.22	3.30
DX 19				
CR	41.54	27.68	-13.86	
COMP	20.93	17.45	- 3.37	10.49
DX 20				
CR	19.37	17.39	- 1.98	
COMP	24.63	22.08	- 2.55	- 0.57
DX 21				
CR	26.67	25.27	- 1.30	
COMP	31.68	27.86	- 3.82	- 2.52
DX 22				
CR	26.36	22.12	- 4.24	
COMP	27.56	23.13	- 4.43	- .19

% Long Stay Regression Analysis by Diagnostic Group: MEDICAID

Dependent Variable: % Long Stays FORM: % Long Stays = $\beta_0 + \beta_1$ STYPE + β_2 TIME + β_3 (STYPE·TIME) + ε

Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-value	p	estimate	t-value	p		
1. Hypertension	-9.1187	-2.31	.0217	4.3610	.71	.4769	358	354
2. Pneumonia	-4.407	-2.07	.0392	.9271	.28	.7808	547	543
3. Heart Failure	-5.6890	-1.31	.1918	-2.4892	-.34	.7307	307	303
4. Urinary Tract Infection	- .6825	-.21	.8331	-3.084	-.55	.5825	433	429
5. Ulcer	-4.2786	-1.07	.2841	-7.8108	-1.17	.2421	394	390
6. Cholecystitis/ Choletithiasis	-10.6980	-3.57	.0004	14.6887	2.88	.0041	512	508
7. Inguinal Hernia	-3.9191	-1.00	.3176	3.6485	.60	.5483	402	398
8. Hyperplasia Prostate	-19.4655	-2.15	.0334	28.5695	2.03	.0440	131	127
9. Disc Displacement	-12.2614	-2.73	.0067	11.5004	1.78	.0760	316	312
10. Complications & Adverse Reactions	-1.9348	-.87	.3854	-2.2499	-.62	.5372	540	536
11. Cerebrovascular Disease	-12.2072	-2.10	.0367	16.7445	2.02	.0439	253	249
12. Chronic Ischemic Heart Disease	-11.3263	-3.60	.0004	-.1552	-.03	.9728	410	406
13. Acute Myocardial Infarction	-7.6344	-1.26	.2104	.9740	.12	.9072	224	220
14. Diabetes	-5.0800	-1.67	.0965	-6.6707	-1.39	.1659	499	495
15. Malignant Neoplasm of Breast	8.7734	1.12	.2622	7.2967	.62	.5365	171	167

Table 6.19

% Long Stay Regression Analysis by Diagnostic Group: MEDICAID

Dependent Variable: % Long Stays FORM: % Long Stays = $\beta_0 + \beta_1$ STYPE + β_2 TIME + β_3 (STYPE·TIME) + ε								
Diagnosis Group	$\hat{\beta}_2$			$\hat{\beta}_3$			OBS.	D.F.
	Estimate	t-value	p	estimate	t-value	p		
16. Delivery	-5.0565	-4.16	.0001	1.6269	.75	.4556	575	571
17. Hypertrophy Tonsils/Adenoids	-.8700	-.81	.4180	2.3911	1.13	.2578	573	569
18. Fracture of Femur	-10.0700	-1.25	.2140	3.9522	.32	.7510	157	153
19. Cataract	-13.9215	-2.57	.0109	10.2129	1.10	.2706	216	212
20. Neuroses	-1.9828	-.87	.3821	-.6222	-.17	.8618	441	437
21. Appendicitis	-1.2902	-.31	.7590	-2.5337	-.35	.7276	372	368
22. Other	-4.2917	-6.20	.0001	-.1631	-.14	.8868	737	733

Prostate (28.73% difference); and Cerebrovascular Disease (17.43% difference). Based on this analysis, it would appear that the null hypothesis that tests the equivalence in the pre-post changes of the % Long Stays for concurrent review and comparison hospitals may be rejected for the three diagnosis groups noted above for the Medicaid sample.

6.4 ANALYSIS OF CHANGES IN DIAGNOSTIC MIX

In this section, the frequency and percent distribution of patients and patient days for the twenty-two diagnosis groups included in the study are analyzed for the pre-review and post-review periods for both the concurrent review and comparison hospitals. The purpose of the analysis was to determine if the PSRO activity resulted in a shift in the mix of diagnoses for the Medicaid patients in the sample. Both the number of patients and the number of patient days were used as indicators of changes in case mix. The null hypotheses to be tested are given below:

H_1: THE CHANGE IN THE PROPORTION OF PATIENTS (PATIENT DAYS) BY DIAGNOSIS GROUP IS EQUAL FOR THE CONCURRENT REVIEW AND COMPARISON HOSPITALS.

H_2: THE PROPORTION OF PATIENTS (PATIENT DAYS) IN CONCURRENT REVIEW HOSPITALS BY DIAGNOSIS GROUP IN THE PRE-REVIEW PERIOD IS EQUAL TO THE PROPORTION OF PATIENTS (PATIENT DAYS) BY DIAGNOSIS GROUP IN THE POST-REVIEW PERIOD.

As with the Medicare patients, the Medicaid sample was also subjected to the elementary index number analyses described in Section 3.2.8. The results are reported in Tables 6.20 and 6.21. As with the Medicare sample, the Medicaid results reveal that virtually no change was observed in diagnostic proportions (as they affect ALOS) for either the PSRO concurrent review (I = 1.0020) or the comparison hospitals (I = 0.9990). However, the diagnostic-specific ALOS decreased (post vs. pre) for both the concurrent

review (I^1 = 0.9616) and the comparison groups (I = 0.9197). As discussed in Section 3.2.8, this result is consistent with the 0.2 day greater decrease for the comparison hospitals that has been observed using more rigorous techniques of analysis.

Table 6.20

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICAID

Index / Hospital Group	Case Mix Adjustment I	ALOS Adjustment I^1
Concurrent Review Hospitals	1.0020	.9616
Comparison Hospitals	.9990	.9197

Table 6.21

Expected Post Period ALOS for Case Mix and ALOS Adjustments, by Hospital Group: MEDICAID

Expected Post Period ALOS / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals Observed Pre-Period ALOS = 6.0876	6.1003	5.8538
Comparison Hospitals Observed Pre-Period ALOS = 6.9550	6.9482	6.9363

Table 6.22 presents the distribution of patients by diagnosis and the pre-review, post-review differences in the proportions for the concurrent review and comparison hospitals. Six of the diagnosis groups for the concurrent review hospitals exhibit statistically significant shifts in the proportions between the pre-review and post-review periods while seven of the diagnoses in the comparison hospitals shift significantly. The largest shifts observed for

TABLE 6.22

Changes in Distribution of Patients by Diagnosis
Between Concurrent Review and Comparison Hospitals: MEDICAID

Diagnosis Group / Hospital Type and Period		Concurrent Review			Comparison		
		Pre	Post	Diff.	Pre	Post	Diff.
1. Hypertension	#	273	283		173	211	
	%	.71	.62	-.092	.87	.79	-.088
2. Pneumonia	#	1075	1255		697	867	
	%	2.80	2.74	-.054	3.52	3.23	-.290
3. Heart Failure	#	165	227		92	114	
	%	.43	.50	+.067	.46	.42	-.040
4. Urinary Tract Infection	#	492	427		207	227	
	%	1.28	.93	-.346*	1.05	.85	-.200*
5. Ulcer	#	290	234		125	149	
	%	.75	.51	-.243*	.63	.56	-.076
6. Cholecystitis/ Cholelithiasis	#	542	574		252	315	
	%	1.41	1.25	-.155*	1.27	1.17	-.099
7. Inguinal Hernia	#	293	312		184	227	
	%	.76	.68	-.080	.93	.85	-.084
8. Hyperplasia Prostate	#	55	58		34	44	
	%	.14	.13	-.016	.17	.16	-.008
9. Disc Displacement	#	197	198		153	197	
	%	.51	.43	-.080	.77	.73	-.004
10. Complications & Adverse Reactions	#	700	859		356	579	
	%	1.82	.43	+.056	1.80	2.16	-.359*
11. Cerebrovascular Disease	#	97	143		98	120	
	%	.25	.31	+.060	.49	.45	-.048
12. Chronic Ischemic Heart Disease	#	346	350		263	344	
	%	.90	.76	-.135*	1.33	1.28	-.047
13. Acute Myocardial Infarction	#	72	111		84	100	
	%	.19	.24	+.055	.42	.37	-.052
14. Diabetes	#	459	552		308	335	
	%	1.19	1.21	+.012	1.56	1.25	-.307*
15. Malignant Neoplasm of Breast	#	85	76		62	57	
	%	.22	.17	-.055	.31	.21	-.101*
16. Delivery	#	5352	6734		2275	3223	
	%	13.92	14.71	+.795*	11.49	12.01	+.518
17. Hypertrophy Toncils & Adenoids	#	2018	1954		649	698	
	%	5.25	4.27	-.978*	3.28	2.60	-.677*
18. Fracture of Femur	#	63	63		39	49	
	%	.16	.14	+.026	.20	.18	-.014
19. Cataract	#	195	224		86	131	
	%	.51	.49	-.018	.43	.49	+.054
20. Neuroses	#	671	857		402	634	
	%	1.74	1.87	+.127	2.03	2.36	+.332*
21. Appendicitis	#	225	277		101	140	
	%	.59	.61	+.020	.51	.52	+.012
22. Other	#	24792	30005		13160	18079	
	%	64.47	65.55	+.617*	66.46	67.36	+.894*

*Shift in proportion is significant at $p < .05$.

the concurrent review hospitals occurred for Hypertrophy of the Tonsils and Adenoids and Delivery with shifts of -.978 and +.795 percentage points, respectively. No diagnosis group in the concurrent review hospitals or the comparison hospitals experienced a shift in proportion of greater than one percent.

The shift in the distribution of diagnosis groups is also apparent when the changes in the days of care by diagnosis group are examined. Table 6.23 shows that the shifts in days of care between the pre-review and post-review periods for the concurrent review hospitals were statistically significant ($p<.05$) for nineteen of the diagnosis groups. The largest percent shift was for the Appendicitis Diagnosis category which showed an increase of 1.708 percentage points between the pre-review and post-review periods for concurrent hospitals. The Other category also showed a relatively large shift of 1.016 percentage points. The largest decrease for the concurrent hospital group was for Ulcer, which dropped from 1.20% to 0.81% of the total patient days. Fifteen of the diagnosis groups in the comparison hospitals also shifted significantly between periods. However, no shift was greater than one percent of total patient days. The largest shifts were increases in the proportion of Deliveries, Neuroses, and the Other diagnosis category. Diabetes experienced the greatest decline in the comparison group of .797 percentage points.

Based on the results as presented in the table, it would appear the null hypotheses regarding the absence of a shift in the case mix should be rejected for the Medicaid patients, especially in light of the relatively large increase in the Other category for the concurrent review hospitals and the relatively small change noted for the comparison hospitals. However, it must be recognized that the large number of patients and patient days in the study contribute to even very small shifts in the proportions being statistically significant. In the absence of additional diagnosis specific utilization data, particularly admission rate information, it is difficult, if not impossible, to make a meaningful interpretation of the observed statistically significant shifts in the diagnostic mix.

Table 6.23

Changes in Distribution of Patient Days of Care by Diagnosis Between Concurrent Review and Comparison Hospitals: MEDICAID

Diagnosis Group	Hospital Type and Period	Concurrent Review Pre	Concurrent Review Post	Concurrent Review Diff.	Comparison Pre	Comparison Post	Comparison Diff.
1. Hypertension	#	2464	2280		1577	1904	
	%	1.05	.85	-.204*	1.15	1.11	-.037
2. Pneumonia	#	7690	8612		5677	6302	
	%	3.29	3.21	-.080	4.13	3.67	-.454*
3. Heart Failure	#	1771	2350		985	1219	
	%	.76	.87	+.118*	.72	.71	-.645*
4. Urinary Tract Infection	#	2682	2353		1376	1191	
	%	1.15	.88	-.270*	1.00	.69	-.306*
5. Ulcer	#	2812	2173		1331	1302	
	%	1.20	.81	-.393*	.97	.76	-.209*
6. Cholecystitis/ Choletithiasis	#	5492	5044		2509	3256	
	%	2.35	1.88	-.469*	1.82	1.90	+.074
7. Inguinal Hernia	#	1162	1259		786	814	
	%	.50	.47	-.028	.57	.47	-.097*
8. Hyperplasia Prostate	#	577	540		315	490	
	%	.25	.20	-.046*	.23	.29	+.057*
9. Disc Displacement	#	2240	2086		1454	1874	
	%	.96	.78	-.181*	1.06	1.09	+.035
10. Complications & Adverse Reactions	#	3853	4816		2285	3008	
	%	1.65	1.79	+.146*	1.66	1.75	+.092*
11. Cerebrovascular Disease	#	1331	1392		969	1254	
	%	.57	.52	-.050*	.70	.73	+.026
12. Chronic Ischemic Heart Disease	#	3319	1762		2401	2577	
	%	1.42	1.04	-.380*	1.74	1.50	-.243*
13. Acute Myocardial Infarction	#	1339	1762		1368	1533	
	%	.57	.66	+.084*	.99	.89	-.101*
14. Diabetes	#	4438	5114		3401	2874	
	%	1.90	1.90	+.008	2.47	1.67	-.797*
15. Malignant Neoplasm of Breast	#	977	850		663	681	
	%	.42	.32	-.101*	.48	.40	-.085*
16. Delivery	#	22088	27074		9101	12827	
	%	9.44	10.08	+.641*	6.61	7.47	+.860*
17. Hypertrophy Toncils & Adenoids	#	3771	3737		1258	1334	
	%	1.61	1.39	-.220*	.91	.78	-.137*
18. Fracture of Femur	#	1542	1364		791	1022	
	%	.66	.51	-.151*	.57	.60	+.021
19. Cataract	#	1152	1213		497	553	
	%	.49	.45	-.041*	.36	.32	-.039
20. Neuroses	#	5849	8217		4718	7195	
	%	2.50	3.06	+.560*	3.43	4.19	+.764*
21. Appendicitis	#	1344	1631		688	892	
	%	.57	.61	+1.708*	.50	.52	-.020
22. Other	#	156141	181945		93469	117541	
	%	66.72	67.73	+1.016*	67.92	68.48	+.561*

*Shift in proportion is significant at $p < .05$.

6.5 ADMISSIONS AND DAYS OF CARE

It was not the primary purpose of this study to examine the impact of PSRO concurrent review activity on the changes in admissions to, and days of care provided in, the hospitals included in the sample. Because of the nature of the study design and the limitations of the sampling plan, there was not available the appropriate eligibility data needed to calculate admission rates or days of care per 1000 population. Therefore, it is not possible to determine if any observed changes in the number of admissions or the days of care have resulted from PSRO impact on hospital utilization, or from changes in the eligibility base, or from changes in other variables not accounted for in the design.

It is for these reasons that the two hypotheses listed below could not be addressed fully within the context of this study:

H_1: THE CHANGE IN THE ADMISSION RATE FOR CONCURRENT REVIEW HOSPITALS IS EQUAL TO THE CHANGE IN THE ADMISSION RATE FOR COMPARISON HOSPITALS.

H_2: THE CHANGE IN THE HOSPITAL DAYS OF CARE RATE FOR CONCURRENT REVIEW HOSPITALS IS EQUAL TO THE CHANGE IN THE HOSPITAL DAYS OF CARE RATE FOR COMPARISON HOSPITALS.

The only reasonable analysis of the changes in admission rates and days of care rate that may be achieved with the limited data available is an analysis of the pooled number of admissions and days of care across concurrent review and comparison hospitals. The change in the proportion of admissions and hospital days of care in concurrent review hospitals versus comparison hospitals may then be calculated and tested for significance. The

distributions of admissions and hospital days of care are given in Tables 6.24 and 6.25. As may be seen from the tables, the proportion of admissions to concurrent review hospitals declined by 3.0% and the hospital days of care declined by 2.0% between the pre-review and post-review periods. Given the large number of observations, these observed changes are statistically significant ($p<.05$). If these measures may be considered as appropriate proxies for the admission rate and hospital days of care rate, it may be indicated that the PSRO review had the effect of reducing slightly the admission rate and days of care rate in concurrent review hospitals as contrasted with comparison hospitals. However, the assumptions that must be made to support this conclusion may not be warranted in that the analysis assumes essentially no change in the proportionate share of admissions and hospital days of care for the concurrent review hospitals and comparison hospitals in their respective hospital service areas between the 1974 pre-review period and the 1976 post-review period. Furthermore, the analysis assumes that the population in the hospital service areas was relatively stable and that no major changes have occurred in the relative capacities of the two hospital groups. Because of the weaknesses in the design, and the small proportionate shift (although statistically significant), it is not felt that there is sufficient evidence to reject the null hypotheses that the admission rate and the days of care rate have remained constant.

Table 6.24

Distribution of Admissions by Pre-Review, Post-Review Period for Concurrent Review and Comparison Hospitals: MEDICAID

Period / Hospital Group	Pre-Review		Post-Review	
	N	%	N	%
Concurrent Review Hospitals	38,457	66.0	45,773	63.0
Comparison Hospitals	19,800	34.0	26,840	37.0
TOTAL	58,257	100.0%	72,613	100.0%

Table 6.25

Distribution of Hospital Days of Care by Pre-Review, Post-Review for Concurrent Review and Comparison Hospitals: MEDICAID

Period / Hospital Group	Pre-Review		Post-Review	
	N	%	N	%
Concurrent Review Hospitals	234,034	63.0	268,619	61.0
Comparison Hospitals	137,619	37.0	171,643	39.0
TOTAL	371,653	100.0%	440,262	100.0%

6.6 ANALYSIS OF LSS EXCLUSIONS: MEDICAID

As was true for the Medicare analysis, transfers, stays over 100 days, deaths, and patients with age, discharge status, or stay unrecorded were excluded from the LSS Program and were therefore excluded from the primary analysis. Data on these excluded patients were analyzed to determine if observed changes for pre to post for these excluded patients varied between the concurrent review hospitals and the comparison hospitals.

An overall summary of Medicaid exclusions is shown in Table 6.26. It can be seen that only small changes in the proportion of patients and patient days excluded were observed for pre to post hospital groups. The largest of the pre to post changes was still less than 1%. It is interesting to note that the overall exclusion rate for Medicaid patients was one quarter the rate observed for Medicare patients. This is as expected because of the greater likelihood for old patients to fall into most of the exclusion categories.

Medicaid exclusions are shown separately for each of the exclusion categories in Table 6.27. Again, only very small differences are observed in the transfer, stays over 100 days and the death rates. ALOS statistics for each of these categories are shown in Table 6.28 The largest change in ALOS was observed for stays over 100 days in the CR hospitals which dropped over 17 days for pre to post. However, the extremely small number of patients in this category makes this finding have little overall significance.

In order to summarize the overall impact of the excluded patients, differences between patients studied and all Medicaid discharges are presented in Table 6.29. While ALOS for excluded patients is 5 to 6 days higher in all categories than ALOS for studied patients, the differences

Table 6.26

SUMMARY OF

MEDICAID EXCLUSIONS

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Post-Pre	Pre	Post	Post-Pre
Total # of patients*	40,196	47,901		29,876	28,271	
# of excluded patients*	1,739	2,128		1,076	1,431	
Proportion of total patients	.043	.044	+.001	.052	.051	-.001
Total patient days*	264,901	302,688		157,805	198,088	
Excluded patient days*	30,867	34,069		20,186	26,445	
Proportion of total days	.117	.113	-.004	.128	.134	+.006
ALOS* for excluded patients	17.75	16.01	-1.74	18.76	18.48	-.28

* For patients with calculable LOS

Table 6.27

MEDICAID EXCLUSIONS
BY REASON FOR EXCLUSION

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Post-Pre	Pre	Post	Post-Pre
Total # of patients*	40,196	47,901		20,876	28,271	
# of excluded patients*	1,739	2,128		1,076	1,431	
Transfers						
#	1,134	1,428		703	975	
Proportion of total patients	.028	.030	+.002	.034	.034	--
Stays over 100 days						
#	36	25		19	27	
Proportion	.001	.001	--	.001	.001	--
Deaths						
#	521	603		349	426	
Proportion	.013	.013	--	.017	.015	-.002
Age or discharge status not recorded						
#	48	72		5	3	
Proportion	.001	.002	+.001	--	--	--

* For patients with calculable LOS

Table 6.28

ALOS FOR MEDICAID EXCLUSIONS

	Concurrent Review Hospitals			Comparison Hospitals		
	Pre	Post	Post-Pre	Pre	Post	Post-Pre
All exclusions	17.75	16.01	-1.74	18.76	18.48	-.28
Transfers	15.56	14.71	-.85	16.83	15.17	-1.66
Stays over 100 days	154.86	137.84	-17.02	144.53	138.85	-5.68
Deaths	13.33	14.65	+1.32	15.85	17.19	1.34

Table 6.29

DIFFERENCES IN UTILIZATION CHARACTERISTICS FOR ALL PATIENTS AND STUDY PATIENTS BY CONCURRENT REVIEW AND COMPARISON HOSPITAL TYPE AND PRE-POST REVIEW TIME PERIOD

MEDICAID

	ALL PATIENTS				STUDY PATIENTS			
	CR Hospitals		Comparison		CR Hospitals		Comparison	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Admissions	40,196	47,901	20,876	28,271	38,457	45,773	19,800	26,840
Patient Days	264,901	302,688	157,805	198,088	234,034	268,619	137,619	171,643
ALOS	6.59	6.32	7.56	7.01	6.09	5.87	6.95	6.40

in ALOS pre to post for the two populations are very similar, providing further justification for the selection of LSS patients as the sampling frame for the study.

6.7 STAGING ANALYSIS

An analysis using the staging index of disease severity was performed for 20,992 patients who could be categorized in one of the 23 staging diagnoses. A staging case mix analysis was performed to evaluate changes in the severity of patients in a given diagnosis group and a LOS analysis was performed to evaluate disease and stage specific changes in ALOS.

6.7.1 Case Mix Severity

For the analysis of case mix severity the 23 diagnoses were split into 2 groups. Group 1 includes 9 diagnoses in which hospitalization is not always necessary for stage 1 patients, while Group 2 contains the remaining 14 diagnoses for which hospitalization is indicated at stage 1. For each staged diagnosis, a 3x2 frequency table was generated where the rows represent the stage (1-3) and the columns represent time (pre vs post). Each cell in the table contained the # of admissions falling into the appropriate stage/time category for that diagnosis. Separate tables were generated for CR hospitals and for non-CR hospitals, and Chi-square tests were run on each frequency table to test for the significance of shifts in severity mix.

Table 6.30 summarizes for the nine Group 1 diagnoses, the proportion of stage 1 patients in each diagnosis. For the CR hospitals, 7 of the 9 diagnoses showed decreases in the proportion of stage 1 admissions from pre to post. This change reflects an increase in the case mix severity for the CR hospitals. For the non-CR hospitals, 4 of the 9 diagnoses showed decreases in the proportion of stage 1 admissions. In addition, a Chi-square test was performed for these 9

TABLE 6.30

MEDICAID

CASE MIX SEVERITY

DX	CR HOSPS - % STAGE 1 PRE	POST	POST-PRE	NON-CR HOSPITALS - % STAGE 1 PRE	POST	POST-PRE
DIARRHEA (GASTROENTERITIS)	.83	,83	0	.85	.81	-.04
DIABETES MELLITUS	.49	.52	+.03 *	.55	.48	-.07 *
ALCOHOLISM	.24	.15	-.09 *	.29	.35	+.06
HYPERTENSION	.34	.29	-.05*	.41	.34	-.07 *
PEPTIC ULCER DISEASE	.73	.72	-.01	.75	.69	-.06
EXTERNAL HERNIA	.95	.93	-.02	.90	.94	+.04
URINARY TRACT INFECTION	.94	.92	-.02	.94	.96	+.02
BENIGN PROSTATIC HYPERTROPHY	.81	.75	-.06	.80	.90	+.10
RHEUMATIOD ARTHRITIS	.21	.19	-.02	.08	.17	+.09
TOTAL	.67	.60	-.07*	.67	.66	-.01

* Chi-Square tests were run on each 3 x 2 matrix of Stage (1 - 3) by time (Pre/Post). Each cell contained the # of admissions falling into the appropriate stage and the category for that diagnosis. The asterisk (*) indicates a significant (p .05) result for the Chi-Square test for that diagnosis.

diagnoses as a group. While a significant ($P<.05$) shift towards a more severe case mix was observed for the CR hospitals the shift, although in the same direction, was of lower magnitude and not statistically significant for the non-CR hospitals.

These findings are extremely interesting in light of the results of the primary analysis of changes in ALOS and may indicate that at least part of the apparently poorer performance by the CR hospitals resulted from the fact that the patients in these hospitals were generally more seriously ill than in the non-CR hospitals.

Similar data for the 14 group 2 diagnoses for which hospitalization is indicated at Stage 1 are shown in Table 6.31 On an overall basis these data indicate a small shift towards greater severity for the CR hospitals and a small shift towards lesser severity for non-CR hospitals. Neither of these changes was statistically significant.

Since the Group 2 diagnoses do require hospitalization at Stage 1, one would not expect large changes in case-mix severity unless treatment patterns have changed. Unfortunately the lack of "denominator" eligibility and readmission data makes detailed analysis of individual diagnoses very speculative. For example, both CR and non-CR hospitals showed an increased level of severity for Carcinoma of the Breast. However, without additional data it is not possible to determine whether this shift resulted from problems in early defection leading to greater case-mix severity, or if the shift in case-mix severity resulted from improvement in treatment effectiveness for advanced stage illness which led to repeat hospitalizations for these patients.

TABLE 6.31

MEDICAID

CASE-MIX SEVERITY

DIAGNOSES REQUIRING HOSPITALIZATION AT STAGE 1

	CR HOSPS - % STAGE 1			$\tilde{CR}$ HOSPS - % STAGE 1		
DX	PRE	POST	POST-PRE	PRE	POST	PRE-POST
COLON CARCINOMA	.632	.318	-.314*	.552	.556	.004
CARCINOMA OF THE BREAST	.512	.400	-.112	.493	.471	-.022
CARCINOMA OF THE CERVIX	.572	.576	.004	.478	.580	.102
CARCINOMA OF THE PROSTATE		INSUF DATA			INSUF DATA	
MYOCARDIAL INFARCTION	.706	.721	.015	.830	.729	-.101
THROMBOPHLEBITIS (PERIPHERAL)	.994	.991	-.003	.985	.729	.015
BACTERIAL PNEUMONIA	.982	.955	-.027	.967	.978	.011
APPENDICITIS	.838	.822	-.016	.817	.850	.033
DIVERTICULITIS	.886	.857	-.029	.733	.792	.059
ULCERATIVE COLITIS	.871	.727	-.144	.650	.692	.042
CIRRHOSIS OF THE LIVER	.777	.765	-.012	.756	.753	-.003
CHOLECYSTITIS	.931	.932	.001	.954	.931	-.023
PANCREATITIS		INSUF DATA			INSUF DATA	
KIDNEY: RENAL CALCULUS DISEASE	.713	.768	.055	.863	.762	-.010
TOTAL	.840	.819	-.021	.824	.834	.010

* (Same footnote as in prior table)

6.7.2 ALOS Analysis

Disease and stage specific changes in ALOS are summarized in Table 6.32. The regression model described in Section 3.3 was run for all patients in each diagnosis and separately for patients in each stage of each diagnosis. As was the case for the overall analysis of ALOS, few statistically significant changes were observed on a diagnosis specific basis. Significant ($p < .05$) decreases in ALOS for the CR hospitals were observed for Diarrhea (Gastroenteritis), Cirrhosis of the Liver and for Cholecystitis, while a significant increase in ALOS was observed for Alcoholism.

The most striking finding from review of the stage specific changes in ALOS is the fact that overall changes in ALOS for a given diagnosis are not necessarily consistent across all stages for that diagnosis. Less consistency was found across the stages than was the case for Medicare patients, perhaps resulting from the greater range of age in the Medicaid population. Whatever the cause, however, this finding indicates an interaction between disease severity and UR effectiveness that should be considered in future PSRO evaluation efforts.

MEDICAID

SUMMARY OF CHANGE IN ALOS (POST-PRE)

DX	ALL ADMISSIONS CR	ALL ADMISSIONS $\widetilde{CR}$	STAGE 1 CR	STAGE 1 $\widetilde{CR}$	STAGE 2 CR	STAGE 2 $\widetilde{CR}$	STAGE 3 CR	STAGE 3 $\widetilde{CR}$	STAGE 4 CR	STAGE 4 $\widetilde{CR}$
DIARRHEA (GASTROENTERITIS)	-1.01*	-.47	-.80	-.57	-2.03	-.22	+1.30	+2.71		
DIABETES MELLITUS	+.20	-2.41	-.41	-.17	+.29	-4.98	+4.58	-3.03		
ALCOHOLISM	+1.70*	-.83	+2.41	-.07	-.15	-.67	+2.60	-1.11		
HYPERTENSION	+.75	+.12	-.86	+.78	-2.91	+.07	+.85	-1.72		
PEPTIC ULCER DISEASE	-.21	-1.00	-.43	-1.96	+.05	+.45	-9.00	+17.00		
EXTERNAL HERNIA	+.19	-1.27	+.13	-1.08	+.78	-2.54	INSUF DATA			
URINARY TRACT INFECTION	+.09	-1.35	-.21	-.57	+.98	-14.60	+2.55	-2.35		
RENIGN PROSTATIC HYPERTROPHY	-.67	+.02	-1.65	-.68	+1.36	+17.00	+4.13	-.83		
RHEUMATOID ARTHRITIS	+1.52	+4.68	+.52	+6.97	INSUF DATA		+1.51	+5.15		
COLON CARCINOMA	+.75	-3.22	+3.38	-3.28	INSUF DATA		-1.56	-2.95		
CARCINOMA OF THE BREAST	-1.12	+2.73	+.12	+.92	-1.88	+5.57	-8.00	+1.00	-2.05	+4.52
CARCINOMA OF THE CERVIX	+.36	-3.25	+.04	-1.70[0]	+1.03	-1.65[1]	+8.75	-11.50	-7.27	-15.21
CARCINOMA OF THE PROSTATE	INSUF DATA		INSUF DATA		INSUF DATA		INSUF DATA			
MYOCARDIAL INFARCTION	-.65	+.41	-.25	-.25	-2.24	+.85	+.13	+1.00		
THROMBOPHLEBITIS (PERIPHERAL)	-2.73	-.15	-2.73	-.17	INSUF DATA		INSUF DATA			
BACTERIAL PNEUMONIA	+.03	-3.47	-.27	-2.70	INSUF DATA		INSUF DATA			
APPENDICITIS	-.12	-.23	-.01	+.24	-1.16	+1.46	-1.20	-14.33		
DIVERTICULITIS	-2.07	+1.21	-2.53	-1.84	-.87	+15.42	INSUF DATA			
ULCERATIVE COLITIS	-1.71	-3.39	-4.79	-6.80	+5.33	+3.25	INSUF DATA			
CIRRHOSIS OF THE LIVER	-3.03*	-2.68	-2.94	-4.06	-3.42	-.14	-3.43	+6.74		
CHOLECYSTITIS	-1.33*	-.25	-1.17	-.19	-4.40	-4.77	+1.31	-2.84		
PANCREATITIS	-2.59	-6.70	-.98	+.40	-6.79	-19.43	INSUF DATA			
KIDNEY: RENAL CALCULUS DISEASE	-.53	+1.46	-1.04	+.66	+1.23	+2.09	+9.40	+7.00		

Note 0 - Stage 0

Note 1 - Stage 1

* Implies a significant ($p<.05$) reduction in ALOS from pre to post for the CR hospitals

6.7.3 ALOS Adjusted for Staging Case Mix Severity

As was done in the Medicare analysis, the Paasche-Lespayres (LOS-Case Mix) adjustments described in Section 3.2.8 were applied using stages within each of the 23 diagnoses as the weighting units.

The results for all 23 diagnoses as a group are shown in Table 6.33A. Purely on the basis of changes in staging case mix between the two periods, the overall ALOS would have been approximately 3% higher in the post (vs. pre) period for the PSRO concurrent review hospitals and 2% lower for the comparison hospital group. As a result of stage-specific decreases in ALOS, however, the overall ALOS would have been about 5% lower in the post (vs. pre) period for the PSRO concurrent review hospitals and 10% lower for the comparison hospitals. The net differences, therefore, between the staging case mix and stage-specific ALOS adjustments were roughly the same for both groups: about an 8% adjusted ALOS decrease (Table 6.33A, right-hand column).

When applied to the 9 Group 1 diagnoses and the 14 Group 2 diagnoses separately (Tables 6.33B and 6.33C), the staging case mix adjustment shows that there was no "severity" effect for the concurrent review hospitals and almost a 3% reduction in staging case mix adjusted ALOS for the comparison hospitals for the 14 Group 2 diagnoses (for which hospitalization is indicated at Stage I). However, based on changes in staging case mix between the post and pre periods, the overall ALOS would have been a little over 5% higher in the post period for the PSRO hospitals and about 2% lower for the comparison hospitals for the 9 Group 1 diagnoses (for which hospitalization is not always necessary at Stage I). This result is consistent with the general increase in severity levels observed previously for the Group 1 diagnoses in the PSRO concurrent review hospitals. It provides further evidence to indicate more appropriate Medicaid hospital utilization in the PSRO concurrent review setting.

Table 6.33A

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

All 23 Diagnoses

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment	Net Difference Case Mix - ALOS
PSRO Concurrent Review Hospitals	1.0348	0.9422	0.0916
Comparison Hospitals	0.9793	0.8992	0.0771

Table 6.33B

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

9 Group 1 Diagnoses

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment	Net Difference Case Mix - ALOS
PSRO Concurrent Review Hospitals	1.0540	0.9887	0.0653
Comparison Hospitals	0.9786	0.8992	0.0794

Table 6.33C

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

14 Group 2 Diganoses

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment	Net Difference Case Mix - ALOS
PSRO Concurrent Review Hospitals	1.0006	0.8763	0.1243
Comparison Hospitals	0.9723	0.8992	0.0731

Tables 6.33B and 6.33C also show that there was a secular decrease in stage-specific adjusted ALOS for both groups of hospitals and for both diagnosis groups. However, while the decrease in stage-specific adjusted ALOS was approximately 9% greater in the comparison (vs. PSRO-CR) hospitals for the Group 1 diagnoses, the reverse was true for the Group 2 diagnoses (more than a 2% greater decrease for PSRO concurrent review than comparison hospitals). The net difference between the staging case mix and stage-specific ALOS adjustments help to clarify the above findings in view of the disparate results of the staging case mix ALOS adjustment for the PSRO concurrent review hospitals versus the comparison group. The net decrease in adjusted ALOS for the Group 1 diagnoses was 6% for the PSRO concurrent review and 8% for the comparison hospitals (Table 6.33B, right-hand column). The corresponding decreases for the Group 2 diagnoses were 12% and 7% (Table 6.33C, right-most column). Hence, for the Group 1 diagnoses, the comparison hospitals experienced a 2% greater net reduction in adjusted ALOS than did the PSRO concurrent review hospitals, while the reverse was true for the Group 2 diagnoses: the PSRO concurrent review hospitals had a 5% greater net reduction in adjusted ALOS. For Medicaid, therefore, the PSRO concurrent review hospitals performed better for the Group 2 diagnoses (for which hospitalization is usually indicated at Stage I) and worse for the Group 1 diagnoses (for which hospitalization is not always necessary at Stage I). This finding is consistent with the results for Medicare: PSRO concurrent review had a diffential ALOS impact based on diagnosis type.

When the Paasche-Laspeyres adjustments were applied to individual diagnoses the results were consistent with our earlier findings (Tables 6.33D through 6.33G). As with the Medicare population, the results for Carcinoma of the Breast and Cirrhosis of the Liver were particularly striking. The staging case mix adjustment for Carcinoma of the Breast indicated that ALOS should be about

2% higher in the post (vs. pre) period for the PSRO concurrent review hospitals based purely on changes in staging case mix. For the comparison hospitals this predicted increase was slightly over 1%. The stage-specific ALOS adjustments, however, actually showed an ALOS decrease of over 10% (post vs. pre) for the PSRO concurrent review hospitals and a 2.9% increase for the comparison group (Table 6.33E). For Cirrhosis of the Liver there was virtually no change in staging case mix severity for either group, but the PSRO concurrent review hospitals experienced a stage-specific ALOS decrease of over 21% while the comparison group showed an 18% decrease in adjusted ALOS (Table 6.33F).

Complete results for all 23 diagnoses are presented in Appendix D.

Table 6.33 D

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICAID

DIARRHEA (GASTROENTERITIS)

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99888	0.82364
Comparison Hospitals	1.00114	0.91275

Table 6.33 E

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

CARCINOMA OF THE BREAST

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.01895	0.90296
Comparison Hospitals	0.98885	1.29060

Table 6.33 F

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

CIRRHOSIS OF THE LIVER

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00174	0.78975
Comparison Hospitals	0.99700	0.82421

Table 6.33 G

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

CHOLECYSTITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99932	0.88068
Comparison Hospitals	1.01950	0.96535

APPENDIX A

File Structure and Variable Definition: Patient Abstract Tape

LAYOUT FOR PATIENT ABSTRACT TAPE

PSRO DATA BASE

Tape Description: Three Volumes

DSN = DISCHG.DATA74 (75&76)
Fixed Block
Number of Records = 366862 ('74)
399208 ('75)
304090 ('76)

VØL=SER = PSRO74, PSRO75, PSRO76
Record Length = 108
Block Size = 32,400

9-track
1600 BPI
Standard IBM Label

Record Description:

For each calendar year, records are grouped by discharge month within Hospital Identifier.
Blanks in a numeric field indicate data unavailable.

POSITIONS	FIELD LENGTH	FIELD TYPE	FIELD DESCRIPTION	NOTES
1	1	N	Study Type coded	1
2-3	2	N	Hospital Identifier	2
4-7	4	N	Date of Title 18 Review Start	3
8-16	9	A/N	Patient Id. Number	4
17-22	6	N	Date of Birth (YYMMDD)	
23	1	N	Age Code	5
24-25	2	N	Age	
26	1	N	Sex 1=Male 2=Female	
27	1	N	Race	6
28-33	6	N	Admission Date (YYMMDD)	
34-35	2	N	Admission Hour (00-23)	
36-41	6	N	Discharge Date (YYMMDD)	
42-44	3	N	Staging Diagnosis	8
45-46	2	N	Staging Variable	7
47-50	4	A/N	Attending Physician	2
51-54	4	A/N	Surgeon (Primary)	2
55-58	4	A/N	Final Diagnosis (H-ICDA-2)	9
59-62	4	A/N	Other Diagnosis (1) (H-ICDA-2)	
63-66	4	A/N	Other Diagnosis (2) (H-ICDA-2)	
67-70	4	A/N	Other Diagnosis (3) (H-ICDA-2)	
71-74	4	A/N	Other Diagnosis (4) (H-ICDA-2)	
75-78	4	A/N	Other Diagnosis (5) (H-ICDA-2)	
79-82	4	A/N	Other Diagnosis (6) (H-ICDA-2)	
83-85	3	A/N	Most important operation (H-ICDA-2)	
86-88	3	A/N	Other operation (1) (H-ICDA-2)	
89-91	3	A/N	Other operation (2) (H-ICDA-2)	
92-94	3	A/N	Other operation (3) (H-ICDA-2)	
95-97	3	A/N	Other operation (4) (H-ICDA-2)	
98-100	3	A/N	Other operation (5) (H-ICDA-2)	
101-103	3	A/N	Other operation (6) (H-ICDA-2)	
104-106	3	A/N	Other operation (7) (H-ICDA-2)	

POSITIONS	FIELD LENGTH	FIELD TYPE	FIELD DESCRIPTION	NOTES
107	1	N	Discharge Status coded: 1 = With approval (to home) 2 = Against medical advice 3 = to other hospital 4 = To SNF 5 = To Other Institution 6 = To Home Health 7 = Expired 8 = To Intermediate Care Facility	
108	1	N	Expected Payment Source coded: 1 = Title 18 2 = Title 19 3 = Title 18 & 19 4 = Title 5 5 = Title 5 & 18 6 = Title 5 & 19 7 = Title 5, 18 & 19	

Notes

1. Study/comparison codes:

   1 = Experimental Hospital
   2 = Control Hospital

2. Disguised Id. number used to group together all abstracts from a given Hospital. Will not be traceable to Hospital tape, or to CPHA or CHDC Hospital Id. numbers.

3. YYMM during which earliest Title 18 Review began.
   If review began on or before the 15th day of month, then that month is given. Otherwise, the next month is used.
   For comparison hospitals, all 1976 startup dates have been recoded to "7603."
   If no review is indicated, this field is zero filled.

4. Modified by abstract service to insure confidentiality.

5. Age code:

   0 = Newborn/Stillborn
   1 = Days
   2 = Months
   3 = Years
   4 = 100+ years

6. Race Code:

   0 = Not Recorded
   1 = Black
   2 = Asiatic
   3 = Other non-White
   4 = Special
   5 = White

7. Indicates severity of primary diagnosis if applicable, blank if not. Two-digit code ranging from 01 to 40. First digit represents major stages (0, I, II, etc.); second digit represents substage therein.

8. Three-digit H-ICDA code indicating the staged diagnosis. Most serious condition which appears as the Final Diagnosis or of which the Final Diagnosis is a complication.

9. If a hospital uses ICDA-8 coding, these fields will be translated from the original codes.

NOTE: Input data did not include date of birth (positions 17-22) or hour of admission (positions 34-35), although both items were listed on the source tape layout. These fields appear here, transcribed from the original tapes, as " 000" and " " respectively.

APPENDIX B

File Structure and Variable Definition: Hospital Data File

LAYOUT FOR HOSPITAL TAPE--PSRO DATA BASE

Tape Description:

File 1
DSN = HØSPMAST | VØL SER = STEINH | 9-track
Fixed Block | Record Length = 148 | 1600 BPI
Number of Records = 188 | Block Size = 14800 | Standard IBM Label

Record Description:

Blanks in a numeric field indicate data not available.

POSITIONS	FIELD LENGTH	FIELD TYPE	FIELD DESCRIPTION	NOTES
1-3	3	N	Hospital Identifier	1
4	1	N	No. of short term beds - grouped	2
5	1	N	Type of Ownership	3
6	1	N	Teaching Status	4
7	1	N	Occupancy Rate - grouped	5
8-11	4	N	YYMM of Binding PSRO Concurrent Review Title 18 start date	6
12-15	4	N	Title 19 start date	6
16	1	N	No. of quarters between precursor Title 19 review stop date and binding Title 19 review start date	7
17	1	N	Delegation Status as of 7/1/76 - coded	8
18	1	N	Type of PSRO	10
19	1	N	Number of Short-term, Non-Federal Hospitals in PSRO area - grouped	11
20	1	N	Census Region	12
21	1	N	Active Non-Federal Physicians per 1,000 Population (MD & DO) - grouped	13
22	1	N	Short-term Non-Federal Beds per 1,000 population - grouped	14
23	1	N	County Short-term General Hospital Occupancy Rate - grouped	15
24	1	N	Population Density per Square Mile - grouped	16
25	1	N	Extended Care Beds per 1,000 Population Aged 65+ - grouped	17
26	1	N	Percentage of Population Aged 65+ - grouped	18

POSITIONS	FIELD LENGTH	FIELD TYPE	FIELD DESCRIPTION	NOTES
27	1	N	Percent of total admissions which are federally financed - grouped	19
28	1	N	Percent of total days-of-care which are federally financed - grouped	20
			Change between 1st (Jan-March 1974) & nth quarter for percent of total admissions which are federally financed:	21
29-34	6	N	n=2	
35-40	6	N	n=3	
41-46	6	N	n=4	
47-52	6	N	n=5	
53-58	6	N	n=6	
59-64	6	N	n=7	
65-70	6	N	n=8	
71-76	6	N	n=9	
77-82	6	N	n=10	
83-88	6	N	n=11	
			Change between 1st & nth quarter for percent of total days of care which are federally financed:	21
89-94	6	N	n=2	
95-100	6	N	n=3	
101-106	6	N	n=4	
107-112	6	N	n=5	
113-118	6	N	n=6	
119-124	6	N	n=7	
125-130	6	N	n=8	
131-136	6	N	n=9	
137-142	6	N	n=10	
143-148	6	N	n=11	

NOTES

1. Assigned by SysteMetrics, can only be used to identify hospital as part of experimental group, national control group, and case study control group.

   first digit: 1 = experimental
   2 = national control
   3 = case study control

   second digits: randomly assigned for each group.

2. Short-term bedsize codes:

   1 = 6-49
   2 = 50-99
   3 = 100-199
   4 = 200-299
   5 = 300-499
   6 = 500+

3. Ownership codes:

   1 = Government - Non-Federal
   2 = Non-Government - non-profit
   3 = Non-Government - for profit

4. Teaching codes:

   1 = teaching program
   2 = non-teaching

5. Occupancy Rate codes:

   1 = 0% - 59%
   2 = 60% - 69%
   3 = 70% - 79%
   4 = 80% - 89%
   5 = 90%+

6. If review began on or before the 15th day of month, then that month is given. Otherwise, the next month is used.
   If non-binding review began 3 or more months prior to binding review, then the warm-up start date is given. For Title 18, if precursor review began prior to 1/1/74 then the precursor start date is indicated. This field is blank for non-review hospitals.

7. A "9" in this field indicates that no Title 19 precursor review was done.

8. Delegation status codes for concurrent review:

0 = Does not apply
1 = Full - excludes MCE review -
Concurrent and Reconsideration (with or without MCE)
2 = Concurrent (with or without MCE)
3 = Non-delegated (with or without MCE)

10. PSRO type codes:

1 = Statewide
2 = Multicounty
3 = Single county or part of county

11. Grouped number of hospitals in PSRO area:

1 = 0% -19% 2 = 20% - 39% 3 = 40%+

12. Census region codes:

1 = North East (ME, NH, VT, MA, RI, CT, NY, NJ, PA)
2 = North Central (OH, IND, IL, MI, WI, MN, IA, MO, ND, SD, Nebraska, Kansas)
3 = South (Del, MD, DC, VA, WV, NC, SC, GA, FL, KY, TN, Alabama, MISS, ARK, LA, OK, TX)
4 = West (MT, Idaho, WY, Colorado, NM, AZ, Utah, Nev, WA, OR, CA, Alaska, Hawaii)

13. Active Non-Federal Physicians per 1,000 population = n.
Grouped such that:

pos. 40 = "1" if $o \leq n < 1$
pos. 40 = "2" if $1 \leq n < 1.5$
pos. 40 = "3" if $1.5 \leq n < 2$
pos. 40 ' "4" if $2 \leq n$

14. Short-term Non-Federal beds per 1,000 population = n.
Grouped such that:

pos. 41 = "1" if $o \leq n < 3.5$
pos. 41 = "2" if $3.5 \leq n < 4.75$
pos. 41 = "3" if $4.75 \leq n < 6.0$
pos. 41 = "4" if $6.0 \leq n$

15. County short-term general hospital occupancy rate = n.
Grouped such that:

pos. 42 = "1" if $0 \leq n < 65$
pos. 42 = "2" if $65 \leq n < 70$
pos. 42 = "3" if $70 \leq n < 75$
pos. 42 = "4" if $75 \leq n < 80$
pos. 42 = "5" if $80 \leq n$

16. Population density per square mile = n.
Grouped such that:

pos. 43 = "1" if $0 \leq n < 50$
pos. 43 = "2" if $50 \leq n < 200$
pos. 43 = "3" if $200 \leq n < 600$
pos. 43 = "4" if $600 \leq n < 2000$
pos. 43 = "5" if $2000 \leq n$

17. Extended care beds per 1000 population Aged 65+ = n.
Grouped such that:

pos. 44 = "1" if $0 = n$
pos. 44 = "2" if $0 < n < 1.5$
pos. 44 = "3" if $1.5 \leq n < 2.5$
pos. 44 = "4" if $2.5 \leq n$

18. Percentage of population aged 65+ = n.
Grouped such that:

pos. 45 = "1" if $0 \leq n < 7$
pos. 45 = "2" if $7 \leq n < 9$
pos. 45 = "3" if $9 \leq n < 10$
pos. 45 = "4" if $10 \leq n < 11$
pos. 45 = "5" if $11 \leq n$

19. Grouped percent of Federally-financed admissions:

1 = 0% - 19%	2 = 20% - 24%	3 = 25%- 29%
4 = 30% - 34%	5 = 35% - 39%	6 = 40%+

20. Grouped percent of Federally-financed days-of-care:

1 = 0% - 29%	2 = 30% - 34%	3 = 35% - 39%
4 = 40% - 44%	5 = 45% - 54%	6 = 55%+

21. Percentage change for each quarter from base quarter (Jan-March 1974) to nearest tenth of a percent (i.e., 34.2=34.2%, -10.8=-10.8%, etc.). This field can be read using ANSI FORTRAN format "F6.1".

APPENDIX C

ALOS Adjusted for Staging Case Mix Severity: Medicare

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

DIARRHEA (GASTROENTERITIS)

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.01550	1.01578
Comparison Hospitals	1.00145	0.79975

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

DIABETES MELLITUS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00395	0.95932
Comparison Hospitals	1.01328	0.94066

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

ALCOHOLISM

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.04689	1.16961
Comparison Hospitals	1.00798	0.88282

Index Values for Case Mix and ALOS
Adjustments, by Hospital Group: MEDICARE

HYPERTENSION

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.02308	1.00940
Comparison Hospitals	1.02341	0.92816

Index Values for Case Mix and ALOS
Adjustments, by Hospital Group: MEDICARE

PEPTIC ULCER DISEASE

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00767	0.94722
Comparison Hospitals	1.00135	0.95299

Index Values for Case Mix and ALOS
Adjustments, by Hospital Group: MEDICARE

EXTERNAL HERNIA

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00367	0.89463
Comparison Hospitals	1.00431	0.91702

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

URINARY TRACT INFECTION

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00602	1.01384
Comparison Hospitals	0.99401	1.07275

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

BENIGN PROSTATIC HYPERTROPHY

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00600	0.94428
Comparison Hospitals	1.00704	0.92096

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

RHEUMATOID ARTHRITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99929	0.93301
Comparison Hospitals	0.99449	0.85434

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

COLON CARCINOMA

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99759	0.94122
Comparison Hospitals	0.99638	0.99880

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

CARCINOMA OF THE BREAST

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.02035	0.89874
Comparison Hospitals	1.00849	1.02695

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

CARCINOMA OF THE CERVIX

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.97157	0.78600
Comparison Hospitals	0.92675	0.65870

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

CARCINOMA OF THE PROSTATE

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99920	0.89786
Comparison Hospitals	1.00418	0.95595

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

MYOCARDIAL INFARCTION

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99235	0.93154
Comparison Hospitals	0.99845	0.91836

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

THROMBOPHLEBITIS (PERIPHERAL)

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99947	1.01618
Comparison Hospitals	0.99975	0.97943

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

BACTERIAL PNEUMONIA

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00845	1.01938
Comparison Hospitals	1.00000	0.94572

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

APPENDICITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99707	0.84092
Comparison Hospitals	1.01509	0.80260

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

DIVERTICULITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.97777	1.02325
Comparison Hospitals	0.99752	1.16254

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

ULCERATIVE COLITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.98264	1.26362
Comparison Hospitals	0.99860	1.65236

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

CIRRHOSIS OF THE LIVER

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00035	0.84313
Comparison Hospitals	1.00313	1.15183

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

CHOLECYSTITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00431	1.00558
Comparison Hospitals	1.01510	0.97209

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

PANCREATITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00794	0.97371
Comparison Hospitals	0.99869	0.96094

Index Values for Case Mix and ALOS Adjustments, by Hospital Group: MEDICARE

KIDNEY: RENAL CALCULUS DISEASE

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.98118	0.97967
Comparison Hospitals	0.97999	0.85171

APPENDIX D

ALOS Adjusted for Staging Case Mix Severity: Medicaid

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

DIARRHEA (GASTROENTERITIS)

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99888	0.82364
Comparison Hospitals	1.00114	0.91275

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

DIABETES MELLITUS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99856	1.01431
Comparison Hospitals	1.00104	0.83012

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

ALCOHOLISM

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.05568	1.11761
Comparison Hospitals	0.96546	0.91972

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

HYPERTENSION

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.05632	0.97420
Comparison Hospitals	1.08520	0.95501

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

PEPTIC ULCER DISEASE

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.02319	0.96558
Comparison Hospitals	1.00686	0.87902

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

EXTERNAL HERNIA

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00449	1.04050
Comparison Hospitals	0.98025	0.75097

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

URINARY TRACT INFECTION

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.02553	0.98537
Comparison Hospitals	0.95440	0.83607

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

BENIGN PROSTATIC HYPERTROPHY

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99344	0.92451
Comparison Hospitals	0.99038	1.03116

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

RHEUMATOID ARTHRITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00736	1.12858
Comparison Hospitals	0.94660	1.37112

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

COLON CARCINOMA

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.03087	1.09539
Comparison Hospitals	0.99630	0.80972

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

CARCINOMA OF THE BREAST

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.01895	0.90296
Comparison Hospitals	0.98885	1.29060

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

CARCINOMA OF THE CERVIX

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.02352	1.01907
Comparison Hospitals	0.94718	0.74737

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

CARCINOMA OF THE PROSTATE

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.95810	0.51190
Comparison Hospitals	1.00000	1.43056

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

MYOCARDIAL INFARCTION

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99994	0.95570
Comparison Hospitals	1.02426	0.99652

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

THROMBOPHLEBITIS (PERIPHERAL)

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00000	0.79811
Comparison Hospitals	1.00000	0.98530

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

BACTERIAL PNEUMONIA

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.01112	0.96414
Comparison Hospitals	1.00000	0.74472

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

APPENDICITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.01602	0.96607
Comparison Hospitals	0.93194	1.00347

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

DIVERTICULITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00017	0.77558
Comparison Hospitals	0.95861	1.22020

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

ULCERATIVE COLITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.02960	0.71240
Comparison Hospitals	1.00404	0.74838

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

CIRRHOSIS OF THE LIVER

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.00174	0.78975
Comparison Hospitals	0.99700	0.82421

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

CHOLECYSTITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.99932	0.88068
Comparison Hospitals	1.01950	0.96535

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

PANCREATITIS

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	1.06263	0.77862
Comparison Hospitals	0.84142	0.57511

Index Values for Case Mix and ALOS Adjustments,
by Hospital Group: MEDICAID

KIDNEY: RENAL CALCULUS DISEASE

Index / Hospital Group	Case Mix Adjustment	ALOS Adjustment
PSRO Concurrent Review Hospitals	0.97361	0.94973
Comparison Hospitals	1.03655	1.13208

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